

OTI - TROUBLE ANALYSIS

OTI - RELAY DESIGNATIONS

ORIG. MKR. - RELAY DESIGNATIONS

OTI - LAMP DESIGNATIONS



ORIGINATING TROUBLE INDICATORS

AUTOMATIC TROUBLE ANALYSIS-TROUBLE REFERENCE GUIDE

NO. 1 CROSSBAR SYSTEM

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1. GENERAL

Scope

1.01 This section provides information to help in understanding the nature of the troubles reported by automatic trouble analysis (ATA) exception reports. Information about each category, or bin, is contained in a short narrative description covering the key circuit operation at the time that the trouble is detected. This section also contains specific reference to source documents which may be useful in troubleshooting.

1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The issue of this section corresponds to:

Issue 2 of SD-25010-01—Test Line Circuit

Issue 117B of SD-25016-01—Originating Marker Circuit

Issue 62B of SD-25018-01—Originating Trouble Indicator Circuit

Issue 23B of SD-25031-01—District Link and Connector Circuit

Issue 48B of SD-25035-01—Originating Marker Connector Circuit

Description of Bin Format

1.04 The following format will be used to describe each bin:

(a) **Bin Name**—Consists mainly of alpha characters which identify the trouble category.

(b) **Description of Circuit Operation**—Description of key circuit operations at the time that the trouble is detected.

(c) **Description of Failure**—Description of the circuit operation which failed to occur and caused a trouble record to be generated. This could also be a positive indication of troubles such as cross-detecting troubles.

(d) **Sequence of Operations**—Sequence charts showing normal circuit operations at the time of the failure are referenced in this paragraph.

(e) **Reference Documents**—SD numbers, associated FS numbers and SC numbers, CD numbers, and paragraph numbers, and related BSPs are referenced in this paragraph.

2. BIN LISTING

2.01 The following index is a listing of all of the bins associated with the originating marker:

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O*A&C	4
O*A&NO-C	5
O*ANI-RP-NO-S1K	6
O*C&NO-A	7
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NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

BIN NAME	PAGE	BIN NAME	PAGE
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O*NO-AK	27	O*NO-ZL	75
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O*NO-AK-M-SW	29	O*OF-LOCK-OUT	77
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O*NO-B	31	O*OPEN-M-LEAD	79
O*NO-BBK	32	O*OTI-TEST	80
O*NO-B-SHUNT	33	O*RL-FAILURE	81
O*NO-BK	34	O*RP1&TP1	82
O*NO-CBK	35	O*SDR-TST-FR	83
O*NO-CC	36	O*TB5	84
O*NO-CH-	37	O*USER-DEF-A	85
O*NO-CHARGE	38	O*USER-DEF-B	86
O*NO-CHE	39	O*X-CHECK-ER	87
O*NO-CK	40	O*X-LA-EA	88
O*NO-CKG	41	O*X-M-LD-TO-BAT	89
O*NO-DF-	42	O*X-ON-M-LEAD	90
O*NO-DK	43	O*X-ROUTE-RELAY	91
O*NO-G-	44	O*XC	92
O*NO-JC-	45	O*XCH	93
O*NO-K-	46	O*XDC	94
O*NO-K4	47	O*XDC-XSM1	95
O*NO-K4/K5	48	O*XDF1	96
O*NO-K5	49	O*XK	97
O*NO-LA/EA	50	O*XLCE	98
O*NO-M-SL	51	O*XLCO	99
O*NO-MRL	52	O*XLG	100
O*NO-NSE/NSO	53	O*XOF	101
O*NO-NSE/SPE	54	O*XRL	102
O*NO-NSO/SPO	55	O*XS	103
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O*NO-PTK	57	O*XSL	105

BIN NAME	PAGE
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O*XSM	107
O*XSM1	108
O*XSS	109
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3. BIN DESCRIPTIONS

3.01 The following pages contain the descriptions of the bins listed in Part 2.

BIN NAME

O*A&C

DESCRIPTION OF CIRCUIT OPERATION

OM—A & C Link Check: In this case, the A and C relays have operated. However, the SL and S relays have not. The operated A and C relays release the AC and AC1 relays which previously operated from off-normal ground. The released AC relay closes the district S lead to ground from the front contacts of the AK1 relay through the back contacts of the S and SL relays. This ground causes the operation of the district secondary and office primary hold magnets, each of which in turn extends the ground to the district link and office link respectively. The district primary and the office secondary hold magnets should also operate, if not already operated, in series with the A and C relays. These in turn close the crosspoints extending the ground through to the district link SL lead and the trunk S lead. When the district secondary and office primary holding magnets have operated, the ground that operated these magnets shunts the A and C relays which release. With these relays and the AC1 relay released and all the holding magnets operated, a circuit is closed for the operation of the S and SL relays.

DESCRIPTION OF FAILURE

The A and C relays did not release. The operation of the A and C relay should have caused AC1 relay to release. Check lock path and contact 4/5T of the AC1 relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2
SC1: R22, S22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02
SD-25016-01 B45, B44
BSP 216-230-501 District Junctor Test
BSP 216-240-501 Office Link & Connector Test
BSP 216-261-501 Orig. Mkr Test
BSP 216-383-503 OGT Test

BIN NAME**O*A&NO-C****DESCRIPTION OF CIRCUIT OPERATION**

OM—A-Link and No-C-Link: The operated A relay releases the AC and AC1 relays which previously operated from off-normal ground. The released AC relay closes the district S lead to ground from the front contacts of the AK1 relay through the back contacts of the S and SL relays. This ground causes the operation of the district secondary and office primary hold magnets, each of which in turn extends the ground to the district link and office link respectively. The district primary and the office secondary hold magnet should also operate if not already operated in series with the A and C relays. These in turn close the crosspoints extending the ground through to the district link S lead and the trunk S lead. When the district secondary and office primary holding magnets have operated, the ground that operated these magnets shunts the A and C relays which release. With these relays and the AC1 relay released, and all the holding magnets operated, a circuit is closed for the operation of the S relay.

DESCRIPTION OF FAILURE

The A relay failed to release. The A relay should have been shunted down by the same ground that operated the district link and connector magnets. Check the ground path from the link through the connector to the A relay. Also check for double connection on the district link and connector circuit.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: R22, S22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02

SD-25016-01 B45 Loc. B/1

SECTION 216-600-301

BIN NAME

O*ANI-RP-NO-S1K

DESCRIPTION OF CIRCUIT OPERATION

OM—Automatic Number Identification Ring Party No-S1 Lead Check: Neither relay PT1 nor PT3 operate if a ring customer originates an ANI call. When the ring party customer originates a call, the party check feature for ANI is not used. In this case, the S1K check path is extended through relay TP1 normal and relay RP1 operated, to operate relay S1K.

DESCRIPTION OF FAILURE

This failure indicates that the S1 lead of the outgoing trunk circuit has not been grounded by the operation of the office link and connector secondary switch. Check that the S relay has operated. Check operate path of the S1K relay back to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: M31

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 27

SD-25016-01 B50

BIN NAME**O*C&NO-A****DESCRIPTION OF CIRCUIT OPERATION**

OM—C Link Check and No-A: The operated A relay releases the AC and AC1 relays which previously operated from off-normal ground. The released AC relay closes the district S lead to ground from the front contacts of the AK1 relay through the back contacts of the S and SC relays. This ground causes the operation of the district secondary and office primary hold magnets, each of which in turn extends the ground to the district link and office link respectively. The district primary and the office secondary hold magnet should also operate, if not already operated, in series with the A and C relays. These in turn close the crosspoints extending the ground through to the district link SL lead and the trunk S lead. When the district secondary office primary holding magnets have operated, the ground that operated these magnets shunts the A and C relays which release. With these relays and the AC1 relay released, and all the holding magnets operated, a circuit is closed for the operation of the S relay.

DESCRIPTION OF FAILURE

At this point in the sequence of marker operation, the C relay should release to close an operate path for the operation of the S relay. The C relay is shunted down by the same ground that operates the office switch hold magnets. However, in this case, either the ground path from the hold magnets to the C relay is opened, or the ground from the OGT is missing. This ground comes through the office link connector, the marker K- relay operated, and the normal DT1, AC1, and C relays. Also check for double connect.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: R22, S22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02

SD-25016-01 B45 E/1

SECTION 216-600-301

BIN NAME

O*CRL

DESCRIPTION OF CIRCUIT OPERATION

OM—Channel Release: For information on operation of marker when all channels are busy, check CD-25016-01, Section 2, Paragraph 42. Also check office records.

For options:

With W option, when the CHL and C4B relays operate, the ground operate path is closed to operate the CRL relay.

With Z option, when the CHL, CBA5, and CBH relays operate, the ground path is closed to operate the CRL relay.

The CRL relay may also be operated from the TBL relay if all trunks on one of the office frames have been found busy after having found all channels to mate the frame are busy.

DESCRIPTION OF FAILURE

This indicates that all permanent signal trunks or channels to these trunks are busy.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E9

SC10: W4

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 42

SD-25016-01 B49

CD-25018-01 Sect. II, Par. 2.53

BIN NAME**O*DT3****DESCRIPTION OF CIRCUIT OPERATION**

OM—DT3—Double Connection Test: The DT3 relay is provided to detect double connections to trunks on the office multiple. During a regular call, the DT2 relays operate, in turn, operating the DT1 relay. When the EL, OL, ER, or OR relay operates, the DT2 relay releases, leaving the winding of the DT1 relay connected to the S1 lead of the selected trunk and removing the make busy ground. As soon as the K- relay operates, the temporary make busy ground is connected to the S1 lead. Therefore, the seizure by another call must be made before the K- relay is fully operated. If there is a false ground or a make-busy ground on the S1 lead of the trunk, the DT1 relay is locked operated. The DT2 relay is released, and the DT3 relay is operated and locked. The call proceeds through channel test up to the release of the HMT1 relay. At this point, with the DT1 and DT3 relays operated, the path to operate the C relay and the office link secondary hold magnet is opened. Release of the HMT1 relay operates the RL1 relay, which, on first and second trials, connects ground to the TRL lead to the district link and connector circuit, causing the sender to release and make a second attempt. The RL relay is then operated and opens the DK lead from the district link and connector, releasing the AK, AK1, LC, F, and DC relays as before. The RX and MRL relays operate, restoring the marker. On third trial, the TRL lead is also grounded, but the sender sets the district junctor with no channel cross-points closed.

When two marker groups use common outgoing trunks, the markers of the second office will be wired using AB wiring. This causes the double connection test in the second group to be delayed until after an idle channel is found. Thus, if both marker groups selected the same trunk, the office AA wiring would make the double connection test first, and finding a ground on the S1 lead would release and so allow the second office to use the trunk.

DESCRIPTION OF FAILURE

The trunk was seized by the second marker before it could be made busy, or there was a false ground on the S1 lead.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E5
SC5: E24

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 18
SD-25016-01 B 50E5
BSP 216-261-501

SECTION 216-600-301

BIN NAME

O*EA-NO-CC

DESCRIPTION OF CIRCUIT OPERATION

OM—Extended Area—No Compressed Code: In offices which are arranged for both sender recycle (compressed code) and access code operation, the marker receives both compressed code and access code information from the sender and the sender recycle circuit over the same CC leads on a two-out-of-five basis. To differentiate between the two uses of the CC leads, the EA lead is used between the sender and the marker. The sender grounds the EA lead on calls where the NPA code is compressed. Calls to foreign areas, which are compressed, may require a prefix digit 1 in order for the marker to complete the call. On these calls, EA lead is grounded, the CC leads are used to transfer the compressed code information from the sender recycle circuit to the marker. In these cases, the marker receives a ground on the PD1 lead from the sender, if the customer has dialed a prefix digit 1, this signal is used to perform the access code function.

DESCRIPTION OF FAILURE

This failure indicates that the EA relay operated and that no CC- relay operated; probable cause of this problem is failure in the transmitting leads or a failure in the code compressor circuit.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: U12

REFERENCE DOCUMENTS

CD-25016-01 Sect. I, Par. 10
SD-25016-01 B14

BIN NAME**O*EA-NO-RR****DESCRIPTION OF CIRCUIT OPERATION**

OM—Extended Area—No Route Relay: The marker may be arranged to operate with subscriber senders arranged for code compression, on calls to numbering plan areas where the first three digits dialed are converted to compressed code. The compressed code indication is registered in the marker by the operation of the two-out-of-five CC- relays. Each combination of CC- relays is unique to a particular NPA code. The EA lead grounded operates the EAR relay. If translation of individual office code in the extended area is required, the EAR relay, through cross-connection of the 11B to 1T punchings, operates ULA relay. The LA (Fig. 53) and/or operated ULA relays connect the U, TN, and H leads to the extended area or 3-digit individual translator. When a single route relay is required for calls to the extended area, the 11G punching of (Fig. 55) is cross-connected to the winding of a route relay.

DESCRIPTION OF FAILURE

This failure indicates that the extended area route relay was not operated. Check that the information from code compressor is correct and that cross-connections are correct. Check transmission leads.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: H18

REFERENCE DOCUMENTS

CD-25016-01 Sect. I, Par. 7 and Sect. II, Par. 8.02(b)

SD-25016-01 B14, B16

SECTION 216-600-301

BIN NAME

O*ERROR

DESCRIPTION OF CIRCUIT OPERATION

OM—Error: When there is a validation failure, this failure is binned as an error. The "& valid" operator succeeds if the specified field is punched or if the field is not punched at all.

DESCRIPTION OF FAILURE

This failure indicates that a nonvalid combination of relays was encountered.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01
SD-25016-01

BIN NAME**O*EXBG****DESCRIPTION OF CIRCUIT OPERATION**

OM—Extra Lead Battery or Ground: The EXBG punching in the originating marker may be connected to any lead for test purposes by means of a test cord. With the EXBG key in the normal position, the lead in the originating marker is tested for the presence of ground. Turning the EXBG key clockwise, prepares the circuit to operate relay EXBG if battery is connected to the lead under test. Operation of relay EXBG causes the EXBG lamp to light.

DESCRIPTION OF FAILURE

This indication is not a failure but indicates a battery or ground (depending on the position of the EXBG key) on the extra lead maintenance test punching EXBG in the originating marker.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25018-01 Sect. II, Par. 2.02
SD-25018-01

SECTION 216-600-301

BIN NAME

O*FLS-CHE

DESCRIPTION OF CIRCUIT OPERATION

OM—False Channel End: When all channels are idle and the ST1 relay operates, the CHE relay operates.

Note: The CHE relay is a fast release relay to prevent the false operation of an additional CH-relay if an earlier choice channel becomes idle at this time, releasing the AB or C relay.

DESCRIPTION OF FAILURE

This indicates that the CHE relay did not release when a CH- relay operated. Check for either a ground, short, or crossed contacts 1 and 3B of the CH- relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: X21

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 25.01

SD-25016-01 B48

BIN NAME**O*FLS-GRD-AK-LD****DESCRIPTION OF CIRCUIT OPERATION**

OM—False Ground on the AK Lead: When the MR and B relays are operated, ground is removed from the coil of the AK and AK1 relays causing the relay to release, as well as the district junctor link and connector LC relay, the district junctor F relay, and the sender DC relay.

DESCRIPTION OF FAILURE

At this point, the AK lead should not be grounded; the fact that it has remained grounded indicates that a false ground is on the AK lead. Check the AK lead for false ground, (X-spring on MR relay 2/3T, or B relay contacts 4/7).

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: X31

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 34

SD-25016-01 B29,54

SECTION 216-600-301

BIN NAME

O*FLS-TK--KM.OP

DESCRIPTION OF CIRCUIT OPERATION

OM—False Transmission Check—KM Option: The TK relay is provided to check that the transmission leads between the marker and sender have continuity. A check relay is inserted with each lead that the marker grounds to the sender. When, and only when, the proper combination of leads and windings of these relays are grounded, a path may be traced through the proper combinations of OB, OG, CR, and CL relays to the winding of the TK relay.

DESCRIPTION OF FAILURE

With KM option, if a transmission lead is open at the originating marker connector or in the sender, the check relay associated with the lead in trouble fails to operate, preventing operation of the TK relay. When the OT1 is connected to the marker, the lead checking relay may operate in series with the lead indicating relay in the OT1. This permits the TK relay to operate and ground the TK lead to the originating trouble indicator.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: R28

REFERENCE DOCUMENTS

CD-25010-01 Sect. II, Par. 11.64
SD-25016-01 B33

BIN NAME**O*FLS-TKE****DESCRIPTION OF CIRCUIT OPERATION**

OM—False Trunk End: When the ST1 relay operates, it closes ground through the normal contacts of the KEL0-KEL8, KOL0-KOL9, KER0-KER9, KOR0-KOR9, and BK relay which operates the TKE relay.

Note: The TKE relay remains operated until a trunk is selected.

DESCRIPTION OF FAILURE

This failure indicates that the TKE relay remained operated after a specific K- relay has operated. Check that there are no ground or shorts in the operate path, or that contacts 1/3T of the K- relays are not shorted or crossed.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: W21

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17.10

SD-25016-01 B41

SECTION 216-600-301

BIN NAME

O*INV-CC

DESCRIPTION OF CIRCUIT OPERATION

OM—Invalid Code Compression: When the sender recycle and code compression feature is used, the sender connects to a code compressor circuit if the digits stored in the ABC register are an area code (0 or 1 in the B register). If the code compressor finds that the ABC code registered requires a 6-digit translation, it operates two-out-of-five CC- relays in the sender recycle circuit associated with the subscriber sender. This combination of CC- relays is unique to the particular area code dialed.

DESCRIPTION OF FAILURE

This failure indicates that a combination of CC- relays operate that were not unique to any area, wrong combination of CC- relays, more than two CC- relays per digit, or less than two CC- relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: U12

REFERENCE DOCUMENTS

CD-25016-01 Sect. I, Par. 8.01, 8.02
SD-25010-01 B15

BIN NAME**O*INV-K4****DESCRIPTION OF CIRCUIT OPERATION**

OM—Invalid Check 4: When the sender has registered the code information, the sender engages the originating marker connector circuit for the purpose of connecting to an originating marker circuit. After the connector circuit selects a marker, a ground is connected to the CKG lead which prepares a path for checking the integrity of the receiving leads from the sender (there are 26 of these leads) and are connected to six sets of relays in the originating marker. In order for the K4 lead to be grounded, the following sets of marker relays must be operated: all four A- relays, all six F- relays, all four D- relays, the TP, AR, OF, and PD1 relays. These relays operate the CK1 and CK3 relays operating the CK4 relay which closes ground over the K4 lead.

DESCRIPTION OF FAILURE

This failure indicates that the check of all the transmission leads between the sender and the marker was not valid. Check for false ground either between the sender and marker or the CK4 operate path.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: P12

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1.01-.04

SD-25016-01 B6, B9

SECTION 216-600-301

BIN NAME

O*INV-K5

DESCRIPTION OF CIRCUIT OPERATION

OM—Invalid Check 5: When the sender has registered the office code information, the sender engages the originating marker connector circuit for the purpose of connecting to an originating marker circuit. After the connector circuit selects a marker, a ground is connected to the CKG lead which prepares a path for checking the integrity of the receiving leads from the sender (there are 26 of these leads) and are connected to six sets of relays in the originating marker. The K5 lead is grounded by the operation of the five B- relays and four C- relays. These relays bring up the CK2 relay which brings up the CK5 relay; these relays operated place ground on the K5 lead.

DESCRIPTION OF FAILURE

This failure indicates an invalid check of the leads between the sender and the marker. Check for a false ground on the operate path of the CK5 relay in the marker or on the receiving lead from the sender to the marker.

NORMAL SEQUENCE OF OPERATION

SD-25076-01 E1
SC1:F12

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1.01-.04
SD-25016-01 B6, F6

BIN NAME**O*LA-NO-CC****DESCRIPTION OF CIRCUIT OPERATION**

OM—Local Area-No Code Compression: When the marker is arranged to operate with subscriber senders arranged for recycle and code compression, the marker receives ground from the subscriber sender over the LA, EA, or CC leads. The sender receives the information as to which lead or leads are to be grounded from the recycle circuit. The LA lead is grounded on calls where the prefix 1-1 is not dialed or on calls to foreign areas when the NPA is not compressed. On calls to numbering plan areas where the first three digits dialed are converted to a compressed code, the compressed code indication is registered in the marker by the operation of two-out-of-five CC- relays. Each combination of CC- relays is unique to a particular NPA code.

DESCRIPTION OF FAILURE

This failure indicates that the CC- leads were not grounded. Ground through the marker connector from the sender should have been applied to a specific lead or leads. If transmission leads are all OK, check that the code compressor is functioning properly.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: U13

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 8.02

SD-25016-01 B14

BSP 216-258-501

BSP 216-258-505

SECTION 216-600-301

BIN NAME

O*LA-NO-RR

DESCRIPTION OF CIRCUIT OPERATION

OM—Local Area-No Route Relay: When the marker is arranged to operate with subscriber senders arranged for code compression and there are calls to numbering plan areas where the first three digits dialed are converted to compressed code, the compressed code indicaton is registered in the marker by the operation of the two-out-of-five CC- relays. Each combination of CC- relays is unique to a particular NPA code. The LA lead ground operates the LAR relay which operates the LLA relay. Relays LA1 (Fig. 53) and/or LLA operated connects the U, TN, and H leads to the local (home) area translator in the marker.

DESCRIPTION OF FAILURE

This failure indicates that the local area route relay did not operate. This could be due to a wrong combination of CC- relays. Check that information from the code compressor is correct. If information is correct, check for correct relay operation.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: H18

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 8.02
SD-25016-01 B14, B16
BSP 216-258-501
BSP 216-258-505

BIN NAME**O*MRL****DESCRIPTION OF CIRCUIT OPERATION**

OM—Marker Release: When the B and AK1 relays release and the S1K relay operates, ground is closed to the winding of the MRL relay, which operates and locks under control of numerous operated relays which must release before the MRL relay can release. The MRL removes ground from leads G and G1 and releases the ST1, ST2, ST3, ST4, and SR relays. These relays open the office and district link and connector start leads. These circuits release and remove the numerous relays that were operated and locked during the marker stage. These relays release, and the last one of them to release opens the locking circuit for the MRL relay which then releases.

DESCRIPTION OF FAILURE

This trouble indicates that the MRL relay in the originating marker is operated, and that trouble was encountered by the originating marker circuit which prevented it from returning to normal. Check for falsely operated relays and if the CK6 relay has reoperated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: M35

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 36
SD-25016-01 B54

SECTION 216-600-301

BIN NAME

O*MS-NO-AK

DESCRIPTION OF CIRCUIT OPERATION

OM—Marker Stage—No-Check Relay: When the marker has advanced to the point where it has released the sender and is in the marker stage, a ground is closed through the normal contacts of the TB and GT2 relays, operated contacts of the 0- and TK relays, normal contacts of the TKE relay, operated contacts of the AK and SR relays, and normal CK6 to operate the ST3 relay. The operated ST3 applies ground to the MS lead through 0 or 00 contacts of the CID relay.

DESCRIPTION OF FAILURE

This failure indicates contacts 5/6T of the AK are shorted.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: U12

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 16.04

SD-25016-01 B35

BIN NAME**O*NO-ABK (FULL MARKER SPEEDUP)****DESCRIPTION OF CIRCUIT OPERATION**

OM—No A Battery Hold Magnet Check: In offices arranged for marker speedup, a dual voltage (+130 -48) surge circuit is provided to operate the hold magnet quickly. Because of this surge circuit, the A relay can operate to a false ground on the hold magnet leads and cannot be used to detect this type of ground. The ABCK relay is provided on the LS lead to the district link. This relay operates only if the lead is supplied with -48 volt battery.

DESCRIPTION OF FAILURE

This failure indicates that either a false ground is on the LS lead or the lead is open. Either one of these conditions prevent the operation of the ABCK relay. This prevents the release of the BCK relay, preventing the release of the HMT1 relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E7
SC8-X12

REFERENCE DOCUMENTS

CD-26016-01 Sect. II, Par. 26
SD-26016-01-B44

SECTION 216-600-301

BIN NAME

O*NO-A-OR-C

DESCRIPTION OF CIRCUIT OPERATION

OM—NO-A-OR-C Relay: The release of the HMT1 relay connects the negative side of the primary and secondary windings of the A relay to the LS lead to the district link and connector frame, and the negative side of the C relay to the LS lead to the office link and connector frame. With the hold magnet battery present and not short-circuited, the current flow through the operate winding is increased, and the current flow through the release winding is decreased sufficiently to operate the A and C relay.

DESCRIPTION OF FAILURE

The A and C relays failed to operate. This indicates that the LS leads from the district link and connector and the office link and connector are either open, or that the HMT1 relay failed to release.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2
SC1: R22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02
SD-25016-01 B44 Loc. B1, F1, H1
BSP 216-261-502 Marker Test
BSP 216-231-501 District Link and Connector
BSP 216-240-501 Line Link and Connector

BIN NAME**O*NO-AK****DESCRIPTION OF CIRCUIT OPERATION**

OM—No Check: The ground originally closed over the DK and DC lead to operate the sender circuit DC relay, the district junctor F relay and the district link and connector LC relay is extended by operation of the LC relay to the AK relay to the marker for operating of the AK and AK' speedup relays.

DESCRIPTION OF CIRCUIT FAILURE

Failure of this relay to operate indicates a failure of the ground from the operated MCB relay (located in the district link and connector) to go through the marker path to the marker connector, to the subscriber sender, the subscriber sender link and connector, through the district link and connector, back to the marker, to operate the AK relays and AK' speedup.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1, E5
SC1:1-S29 Nonspeedup
SC5:5-K11 Speedup

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 15.04
SD-25016-01 29D3

SECTION 216-600-301

BIN NAME

O*NO-AK-M

DESCRIPTION OF CIRCUIT OPERATION

OM—No AK and M-Lead Check: Ground is applied to the DK lead from the operated MCB- relay located on the district link and connector (nonspeedup marker) or from the operated DK' relay on a (speedup marker). This ground operates the sender circuit DC relay, the district junctor F relay, and the district link and connector LC- relay. The ground is then extended by the operated LC- relay to the marker AK lead to operate the AK, AK1, and speedup marker AK' relays.

The district junctor circuit appears on the horizontals of the district link primary switch. The district junctor F relay, when it operates, connects ground to the M- lead of the corresponding primary select magnet.

DESCRIPTION OF FAILURE

The AK and M- leads on the marker were not grounded from the district link and connector circuit. Check if the performance relay MP- in the district junctor link has operated. If the MP- relay has operated, check lead continuity through the marker and other associated circuits.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1, E5
SC1:1-R28 Nonspeedup
SC6:5-AB24 Speedup

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 14.04
SD-25016-01
BSP 216-230-501 District Link and Connector
BSP 216-230-503 District Junctor Test

BIN NAME**O*NO-AK-M-SW****DESCRIPTION OF CIRCUIT OPERATION**

OM—No AK or M- Lead Switch: The ground, which originally closed over the DK and DC leads, used to operate the sender circuit DC relay, the district junctor F relay, and the district link and connector LC relay, is extended by the operation of the LC relay to the AK lead to the marker for operating the AK and AK1 relays.

The ground on the M lead is applied when the district junctor F relay is operated. Ground on this lead indicates the select magnet operated on the district primary switch, indicating the district link primary switch level.

The district link and connector LC and TI relays, when operated, apply a ground to the LC lead. This ground operates the SW- relay in the OTI circuit. The TI relay in the district link and connector is operated when the CIA relay in the marker comes up.

DESCRIPTON OF FAILURE

The AK relay did not operate and the M and LC leads to the OTI were not grounded. The fact that the AK relay did not operate is an indication that AK lead from the district link and connector circuit has not been grounded. Check if the F relay in the district junctor operated. The presence of DK relay indicates that a ground was placed on the DK lead from the district link and connector circuit. Therefore, check the DK lead continuity through the marker, the DC lead through the originating marker connector, subscriber sender, subscriber sender link and controller, and district junctor, the FC lead through the district link and connector, back to the marker AK lead to the AK relay and speedup marker AK' relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1, E5
SC1:1-R29 Nonspeedup marker
SC6:5-AB21 Speedup Marker

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 14.04
SD-25016-01 29D3, E3
BSP 216-230-501 District Link and Connector
BSP 216-230-502

SECTION 216-600-301

BIN NAME

O*NO-AK-SW

DESCRIPTION OF CIRCUIT OPERATION

OM—No Check Switch: Ground is applied to the DK lead from the operated MCB- relay located on the district link and connector (nonspeedup marker) or from the operated DK' relay on a (speedup marker). This ground operates the sender circuit DC relay, the district link F relay, and the district link and connector LC- relay. The ground is then extended by the operated LC- relay to the marker AK lead to operate the AK, AK1, and AK' speedup marker relays.

When the CIA relay in the marker operates, it closes ground over the TI lead to the district link and connector, through the operated MCA- relay closing ground to operate the TI relay. The operated TI relay applies ground to the LC0-11 relays (one LC- relay is associated with each switch), then to the originating trouble indicator operating the SW- relay associated with the switch that is operated in the district link and connector.

DESCRIPTION OF FAILURE

In this case the M indication shows that the F relay in the district junctor has operated; therefore, the ground path up to the district link and connector is good. The problem seems to be that the district link and connector (LC-) relay has not operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1, E5
SC1:1-S30, W30 Nonspeedup
SC5: -AB24 Speedup

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26
SD-25016-01-B29

BIN NAME**O*NO-B****DESCRIPTION OF CIRCUIT OPERATION**

OM—B-Link Check: With relays A, C, and AC1 released, and all the switch holding magnets operated, a circuit is closed for operating the S and SL relays. These relays connect ground to the winding of the A and C relays to hold them in the nonoperate position and remove the direct ground to the holding magnet. However, ground through the winding of the B relay will hold the magnets as well as the S and SL relays operated. The B relay will now operate in series with the holding magnets and S and SL relays.

DESCRIPTION OF CIRCUIT FAILURE

The B relay did not operate—check for a false ground on the holding magnet circuit caused by a double connection.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: W29

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.03

SD-25016-01 B44F1

BSP 216-637-301

BIN NAME

O*NO-BBK (FULL MARKER SPEED UP)

DESCRIPTION OF CIRCUIT OPERATION

OM—No - B Battery Hold Magnet Check: In offices arranged for marker speedup, a dual voltage (+130 -48) surge circuit is provided to operate the hold magnet quickly. Because of this surge circuit, the (B) relay can operate to a false ground on the hold magnet lead and cannot be used to detect this type of ground. The BBCK relay is provided on the S lead to the district link. This relay operates only if the S lead is supplied with -48 volt battery verifying the integrity of the B linkage.

DESCRIPTION OF FAILURE

This failure indicates that either a false ground is on the S lead or the lead is open; these conditions prevent the operation of the BBCK relay. The normal BBCK relay prevents the release of the BCK relay, preventing the release of the HMT1 relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E7
SC8-X12

REFERENCE DOCUMENTS

CD-26016-01 Sect. II, Par. 26
SD-26016-01-B44

BIN NAME**0*NO-B-SHUNT****DESCRIPTION OF CIRCUIT OPERATION**

OM—B-Link Check: Release of the district junctor circuit F relay connects ground to the S lead to the district link and connector circuit. This ground is used to hold the district and office hold magnet during conversion, and it also short-circuits the operate winding of the B relay and increases the current flow through its winding causing it to release. Release of the B relay indicates that the district junctor circuit has functioned to connect the holding ground.

DESCRIPTION OF FAILURE

This failure indicates that the B relay has not been shunted down by the release of the F relay in the district junctor. Check if F relay is released, if it is released, check if hold magnets operated; if magnets have operated, check wiring to district link and connector.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: V35

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.03

SD-25016-01 B44 F1

SECTION 216-600-301

BIN NAME

O*NO-BK

DESCRIPTION OF CIRCUIT OPERATION

OM—No BK Relay: A marker relay EL, OL, ER, or OR operates grounding either E or O lead. This lead is connected through the CB relays to the operated office frame relay and operates the proper JC relay. The operated JC relay connects resistance battery over the JC lead to operate one of the district link and connector circuit JC relays which closes the test leads to a maximum of 20 office junctors and connects ground to the BK lead for operating the BK and BK' speedup marker relays.

DESCRIPTION OF CIRCUIT OPERATION

This failure indicates that the BK lead was not grounded to operate the BK and BK' speedup marker relay. Check if one of the following marker relays is operated: EL, OL, ER, or OR; check that a CB relay has operated. Check for lead continuity on (nonspeedup) markers through the operated contacts of the SR relay (speedup) marker through the operated contact of the AK' relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1:1X10

REFERENCE DOCUMENTS

CD-25016-01 Sec. II Par. 23.01
SD-25016-01 B29, A2

BIN NAME**O*NO-CBK (FULL MARKER SPEED UP)****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - C Battery Hold Magnet Check: In offices arranged for marker speedup, a dual voltage (+130 -48) surge circuit is provided to operate the hold magnet quickly. Because of this surge circuit, the C relay can operate to a false ground on the hold magnet lead and cannot be used to detect this type of ground. The CBBK relay is provided on the LS lead to the office link. This relay operates only if the LS lead is supplied with -48 volt battery.

DESCRIPTON OF FAILURE

This failure indicates that either a false ground is on the LS lead or the lead is open; either one of these conditions prevent the operation of the CBBK relay. The normal CBBK relay prevents the release of the BCK relay, preventing the release of the HMT1 relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E7
SC8-X12

REFERENCE DOCUMENTS

CD-26016-01 Sec. II, Par. 26
SD-26016-01-B44

SECTION 216-600-301

BIN NAME

O*NO-CC

DESCRIPTON OF CIRCUIT OPERATION

OM—No CC- Lead Grounded: On access code operation without sender recycle, the sender grounds two out of five CC- leads to the originating marker on every call to indicate access code information. Additional combination of CC- leads may be grounded to provide for operation with 2-digit prefix codes and interchangeable office and area codes.

DESCRIPTION OF FAILURE

This failure indicates that no CC- lead from the Code Compressor is grounded.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 9
SD-25016-01 B14, B15

BIN NAME**O*NO-CH-****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Channel: There are 20 sets of AB, C, and CH- relays in the marker used for testing a maximum of 20 channels. These relays are designated L0 to R9 (L0, R0, L1, R1, etc) in order, conforming to the switch location of the office junctor at both the secondary of the district link and connector and the primary of the office link and connector. The operation of the CHT relay (this relay is condenser timed; the reason for this delay is to allow time for the AB and C relays to operate; these relays, when normal, indicate an idle channel) causes the CH- relay for the first idle channel to operate and lock.

DESCRIPTION OF CIRCUIT OPERATION

This failure indicates that no channel selection relay CH- operated. Check operate path through the CHE, JD, and HMT1 relays operated. (**Note:** The CHE relay releases as soon as a CH- relay operates.) Check that the timed CHT relay has operated. Check that the CHL relay has not operated falsely.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: X13

REFERENCE DOCUMENTS

CD-26016-01 Sect. II, Par. 24

SD-26016-01 B48

BIN NAME

O*NO-CHARGE

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Charge: The three modes of charging are talking charge TC, operator talk OT, and no charge NC; these relays are operated in series with the route relay for the purpose of setting the district junctor in the proper charge position. The auxiliary relay of each of these relays are the TC1, OT1, and NC1 and are operated by ground through the ST1 relay operated and the ST4 and ST5 relay normal and through the operated charge relay.

DESCRIPTION OF CIRCUIT FAILURE

This failure indicates that no charging relay has been operated. Check that the ST1 relay is operated and that the ST4 and ST5 are normal. Also, if one of the following relays has operated: TC, OT, or NC.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: I18

REFERENCE DOCUMENTS

CD-25016-01 Sec. II, Par. 29, 30, 31

SD-25016-01 B1

BIN NAME

O*NO-CHE

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Channel End: When the ST1 relay operates and if all of the CH- relays are normal, the CHE relay operates. When an idle channel has been found, the CHE relay releases

DESCRIPTION OF CIRCUIT FAILURE

This failure indicates that a CH- relay may be falsely operated, or that the ground path through contacts 1/2B of ST1 relay is open.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: X21

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 25

SD-25016-01 B48

SECTION 216-600-301

BIN NAME

O*NO-CK

DESCRIPTION OF CIRCUIT OPERATION

OM—No - Check Office Link: When the following relays in the office link and connector circuit operate, SS, LC-, and MCB, ground is applied to the CK lead to the marker. This ground is then extended to the marker to operate relay CK.

DESCRIPTION OF FAILURE

This failure indicates that the CK relay did not operate. Possible cause for this failure is that the SS, LC-, or MCB relays in the office link and connector did not operate, or that the contacts of these relays did not make.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: X5

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 22

SD-25016-01 B29

BIN NAME**O*NO-CKG****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Sender Connected Check: When the sender is attached, CKG lead to the originating marker is grounded through the originating marker connector, as an indication that the subscriber sender is attached.

DESCRIPTION OF FAILURE

This failure indicates that the CKG lead from the subscriber sender was not grounded. Check if the CK-relay operated; if it has, the problem is in the lead between the originating marker and the originating trouble indicator. If the CK- relays did not operate, check the CKG lead through the originating marker connector.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: X7

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1.03

SD-25016-01 B6

BIN NAME

O*NO-DF-

DESCRIPTION OF CIRCUIT OPERATION

OM—No - District Frame: A marker circuit DF relay operates and locks, depending upon the district frame registration on the F- group of recording relays. There is a DF- relay in the marker for each district link and connector frame in the office, these relays being designated 0 to 19 or as required. The DF- relay operation is controlled by the district frame indication received from the sender, and corresponding in number to the district link and connector frame through which the call is being completed.

DESCRIPTION OF FAILURE

This failure indicates that the district link and connector was not selected from information received from the sender. Check if F- relays operated and if the combination of F- relays are a valid combination. If the combination is valid, check that ST1 and TK1 relays operated, check that AK, KP1, and ST4 are normal. Check relay contacts if relay combinations are valid.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: W22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 4
SD-25016-01 B9A1

BIN NAME**O*NO-DK****DESCRIPTION OF CIRCUIT OPERATION**

OM—No DK Lead Ground: The DK lead on the marker is grounded from the operated MCB- relay located in the district link and connector on a (nonspeedup marker). On markers that are arranged for (speedup), the ground is applied to the DK lead from the operated DK' relay.

DESCRIPTION OF FAILURE

This failure indicates that the DK lead was not grounded. Check if the preference relay in the district link and connector has operated. If the preference relay has operated, check if MCA- relay has operated on the (nonspeedup marker), or that the DK' relay has operated on the (speedup markers).

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1, E5
SC1:1-W25 Nonspeedup
SC5:F6 Speedup

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 14
SD-25016-01-B29

SECTION 216-600-301

BIN NAME

O*NO-G-

DESCRIPTION OF CIRCUIT OPERATION

OM—No- Group Relays: In order to distribute the traffic as evenly as possible through the various units of the office frame, as well as to distribute calls to the different trunk subgroups of large trunk groups, the marker is arranged to route the calls successively to different subgroups of trunks. When the CK6 and CK6A relays have operated, the GW0 relay operates. After the first call, when the GZ0 relay operates, the GW1 operates. In like manner, the GZ1 controls the GW2 and GZ2 which, in turn, controls the GW3 and GZ3. With this arrangement on successive calls, the leads numbered 0 through 11 are grounded, and the line numbered G0A-11A, G0B-11B, and G0C-11C relays in Fig. 9, 9A, and 9B are operated.

DESCRIPTION OF FAILURE

This failure indicates that the trunk subgroup relay was not operated. Check that the CK6, CK6A relays operate; also check the operation of the GW-, or GZ- relays. Check the operate path of the G- relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: Y18

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 43
SD-25016-01 B56, B57

BIN NAME**O*NO-JC-****DESCRIPTION OF CIRCUIT OPERATION**

OM—When one of the following relays operate, EL, OL, ER, or OR, ground is applied to either the even or odd lead, which is connected through the CB- relays to the operated office frame relays and operating the proper JC relay. The operated JC relay connects resistance battery over the JC lead to operate one of the district link and connector circuit JC relays which closes the test leads maximum of 20 office junctor connectors.

DESCRIPTION OF CIRCUIT FAILURE

This failure indicates that no potential was applied to the upper winding of the marker JC- relay. Check cross-connection information to determine which JC- relay should be operated. On (nonspeedup markers) check that the ground is applied from the operated ST1 relay to operate the JC- relay. On markers that are arranged for (speedup), a momentary surge of +174 volts is applied to the JC- relay. Check for +130V at the JC1 resistor; also check continuity through JC resistance lamp and JC diode.

NORMAL SEQUENCE OF OPERATION

SC1:Z4 Nonspeedup

SC6:R23 Speedup

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 23.1

SD-25016-01 B43

SECTION 216-600-301

BIN NAME

O*NO-K-

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Trunk Selection: When the PT relay operates, it closes ground through contacts of the TKE relays through the operated DF0-19 relays, through the normal or operated contacts of the AR1 relay to the operated groups start TG, E1, etc, relays to a T- relay, representing the first trunk of the group, then through the chain contacts until the first unoperated T- relay is found. The path is then continued through the back contacts of the unoperated T- relay to the winding of the associated K- relay which operates and locks.

DESCRIPTION OF FAILURE

This failure indicates that no outgoing trunk selection relay was operated. Check the K- relay ground and battery path continuity.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: G31

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17.10
SD-25016-01 B29, B41
BSP-216-633-301

BIN NAME**0*NO-K4****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Check 4: When the sender has registered the code information, the sender engages the originating marker connector circuit for the purpose of connecting to an originating marker circuit. After the connector circuit selects a marker, a ground is connected to the CKG lead which prepares a path for checking the integrity of the receiving leads from the sender; there are 26 of these leads and are connected to six sets of relays in the originating marker. In order for the K4 lead to be grounded, the following sets of marker relays must be operated: all four A- relays, all six F- relays, all four D- relays, the TP, AR, OF, and PD1 relays. These relays operate the CK1 and CK3 relays, operating the CK4 relay which closes ground over the K4 lead.

DESCRIPTION OF FAILURE

This failure indicates that a satisfactory check was not made by the originating marker of information from the sender of K4 information. Check that the connector relays have operated, that all the required relays have operated, and for receiving lead integrity. Check if CK1, 3, and 4 relays have operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: P10

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1

SD-25016-01 B6

BIN NAME

O*NO-K4/K5

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Check 4 or Check 5: When the sender has registered the code information, the sender engages the originating marker connector circuit for the purpose of connecting to an originating marker circuit. After the connector circuit selects a marker, a ground is connected to the CKG lead which prepares a path for checking the integrity of the receiving leads and is connected to six sets of relays in the originating marker. In order for the K4 lead to be grounded, the following sets of marker relays must be operated: all four A- relays, all six F- relays, all four D- relays, the TD, AR, OF, and PD1 relays. These relays operate the CK1 and CK3 relays operating the CK4 relay which closes ground over the K4 lead. The K5 lead is grounded by the operation of the five B- relays and four C- relays. These operated relays bring up the CK2 relay which brings up the CK5 relay. This relay operated places ground on the K5 lead.

DESCRIPTION OF FAILURE

This failure indicates that a satisfactory check was not made by the originating marker of the information from the sender. Check that the connector relays have operated; check that all the required relays have operated and for receiving lead integrity; also check that CK1, 2, 3, 4, and 5 relays have operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: 12F, 12P

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1

SD-25016-01 B6

BSP 216-633-301

BIN NAME**O*NO-K5****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Check 5: When the sender has registered the code information, the sender engages the originating marker connector circuit for the purpose of connecting to an originating marker circuit. After the connector circuit selects a marker, a ground is connected to the CKG lead, which prepares a path for checking the integrity of the receiving leads from the sender; there are 26 of these leads and are connected to six sets of relays in the originating marker. The K5 lead is grounded by the operation of five B- relays and four C- relays. These relays bring up the CK2 relay which brings up the CK5 relay; these relays operated places ground on the K5 lead.

DESCRIPTION OF FAILURE

This failure indicates that a satisfactory check was not made by the originating marker of the information from the sender of K5 information. Check that the connector relays operated. Also check that all the required relays have operated and for receiving lead integrity. Check that CK2 and 5 relays have operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: F12

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 1

SD-25016-01 B6, F6

BSP 216-633-301

SECTION 216-600-301

BIN NAME

O*NO-LA/EA

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Local or Extended Area: When the marker is arranged to operate with subscriber senders arranged for recycle or code compression, the marker receives ground from the subscriber sender over the LA, EA, and CC leads. The LA lead is grounded on calls to foreign areas when the code is not compressed and the EA lead is grounded on all calls requiring code compression.

DESCRIPTION OF FAILURE

This failure indicates that neither the LA or EA leads were grounded. Ground through the marker connector from the sender should have been applied to the LA or EA leads. If the transmission leads are correct, check that the code compressor is functioning properly.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E3

SC2: T27

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 8.02

SD-25016-01 B14, H1

BSP 216-258-501

BSP 216-258-505

BIN NAME**O*NO-M-SL****DESCRIPTION OF CIRCUIT OPERATION**

OM—NO-M(0-9) - SL Lead Grounded: Each district junctor is assigned to a particular switch level (select magnet) of the primary switch of the district link and connector circuit. When the F- relay of the district junctor operates, it applies ground to the M lead, which operates the select magnet associated with the primary switch of the district link and connector circuit. When the district link secondary and office link primary holding magnets have operated, the ground that operates these magnets shunts the A and C relays which release. With these relays and the AC1 released and all the holding magnets operated, a circuit is closed which applies ground to the marker SL lead through the district junctor.

DESCRIPTION OF FAILURE

This failure indicates that the SL and M leads from the district link and connector circuit were not grounded. Check contacts 9/10B of F relay in the district junctor. Check that all relays required to complete the operate path for the SL relay have operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: S26 and W29

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02
SD-25016-01 B45

SECTION 216-600-301

BIN NAME

O*NO-MRL

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Marker Release: When the B and AK1 relays release and the SIK and SR relays in the marker and the MCB- relay in the district link and connector have operated, ground is closed to the winding of the MRL relay, which operates and locks under control of the numerous operated relays which must release before the MRL relay can release (this is a normal release). The MRL relay is also operated when the TM9 and TM10 relays operate (see information in CD on timing circuits CD - Sect. II, Par. 56).

DESCRIPTION OF FAILURE

This failure indicates that the marker functions were not completed. Check the operate path for the MRL relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2
SC1: M36

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 36.01
SD-25016-01 B54

BIN NAME**O*NO-NSE/NSO****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Nonsplit Even or Nonsplit Odd Leads Have Not Been Grounded: When TL and TR relays on the even numbered office frame are operated, the NSE relay operates if the trunks are on a level that is not split, while the SPE relay operates if the trunk level is split. Likewise, the NSO or SPO relays are operated when the TL and TR relays operate on the odd numbered office frame. The NSE and NSO relays must both operate before the PT relay can operate to make connection to an outgoing trunk.

DESCRIPTION OF FAILURE

This failure indicates that no nonsplit even and odd leads from the office link and connector frame were grounded. This failure can be due to an open lead or one of the following relays not operating MCA, TL, or TR. (For other possible causes of failures, see CD, Sec. II, Par. 17.04.)

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: C26 & E26

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17
SD-25016-01 B37

SECTION 216-600-301

BIN NAME

O*NO-NSE/SPE

DESCRIPTION OF CIRCUIT OPERATION

OM—No-NonSplit Even or Split Even Leads Have Been Grounded: When TL and TR relays on the even numbered office frame are operated, the NSE relay operates if the trunks are on a level that is not split, while the (SPE) relay operates if the trunk level is split. The relays NSO or SPO must operate with an associated NSE or SPE relay before the PT relay can operate to make connection to an outgoing trunk.

DESCRIPTION OF FAILURE

The failure indicates that no nonsplit even or split even leads from the office link and connector frame were grounded. This failure can be due to an open lead, or one of the following relays did not operate: MCA, TL, or TR. (For other possible causes of failures, see CD, Sect. II, Par. 17.04.)

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: E26

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17

SD-25016-01 B37

BIN NAME**O*NO-NSO/SPO****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Nonsplit Odd or Split Odd Leads Have Been Grounded: When the TL and TR relays on the odd numbered office frame are operated, the NSO relay operates if the trunks are on a level that is not split, while the SPO relay operates if the trunk level is split. The relays NSE or SPE must operate with an associated NSO or SPO relays before the PT relay can operate to make connection to an outgoing trunk.

DESCRIPTION OF FAILURE

This failure indicates that no nonsplit odd or split odd leads from the office link and connector frame were grounded. This failure can be due to an open lead or one of the following relays did not operate: MA, TL, or TR. (For other possible causes of failure, see CD, Sect. II, Par. 17.04.)

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: E26

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17

SD-25016-01 B37

SECTION 216-600-301

BIN NAME

O*NO-OF-

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Office Link and Connector Frame: When the ST1 relay operates, it closes battery through a resistance and the back contact of the ST3, back contacts of G1-4, front contact of the operated route relay, to the office link and connector circuit in order to connect to a pair of office frames through which a trunk to the desired office can be reached. When a pair of office frames have been selected, a ground is returned to the marker circuit over lead OK. This operates the frame relay 0-0 through 0-9 corresponding to the pair of office frames selected (Leads LK0-9).

DESCRIPTON OF FAILURE

This failure indicates that no (OK0-9) leads from the office link and connector frame to the marker were grounded. Check battery path through the marker to the office link and connector (ST- lead). Also check the OK- lead for ground from the office link.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: F23

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 12.02, 12.03
SD-25016-01 B31
BSP 216-635-301
BSP 216-639-301

BIN NAME**O*NO-PTK****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Party Check: Release of DT1 relay also energizes polar timed relay PT2. Approximately 27 ms later, relay PT2 operates between release of relay DT1 and operation of the office link secondary hold magnet. The operated relay PT2 disconnects the 130 volt signal from the S1 lead and substitutes ground through the PTK primary winding. If the ANI trunk has properly registered receipt of the tip-party signal, a low resistance battery is connected by the trunk to the S1 lead to operate relay PTK in this circuit. Relay PTK locks operated through its secondary winding to ground.

DESCRIPTION OF FAILURE

This failure indicates that tip-party information was not transmitted to the ANI outgoing trunk over the S1 lead. Check operate path through marker; if this is correct, check relay operate times.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SD1: F28

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 28.09, 28.10

SD-25016-01 B50

BIN NAME

O*NO-PTY

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Party Indication: Senders that serve two-party message rate customers must indicate to the marker which party is calling in order that the marker may set the district junctor for charging the right customer. The sender passes this information to the marker by grounding the TP lead only if the tip party of a two-party message rate line is calling.

When the CK1 and CK3 relays release, the CK6 relay operates and on tip-party calls, the TP relay is held operated from the sender, the TP1 relay operates and locks under control of the ST1 relay until the district has been connected, and locks over the ZK lead. The operated TP1 relay applies ground to the TP lead. This ground through the district link and connector to the attached district junctor unit operates the tip-party relay in the district junctor so that the correct party will be charged for the call.

On calls from lines other than tip-party lines, the TP relay will release when the CK4 relay operates, and a circuit is closed for operating the RP1 relay. This relay locks and closes; like the TP1 relay, a check path through which the SL relay will operate later. This path is taken through the contacts of the TP1 and RP1 relays so that only one of these relays must be operated to close the check path which, if not closed, will cause the circuit to block and time out.

Note: When a call using ANI is originated by a tip-party customer in an office arranged for two-party lines, relay TP1 is operated the same as above. The operated TP1 through an operated RA- relay operates relays PT1 and PT3. The PT1 and PT3 relays apply +130V to operate the tip-party relay in the OGT.

DESCRIPTION OF FAILURE

This failure is an indication that no party information RP or TP was transmitted from the subscriber sender. Possible cause of this failure is open transmission leads or check operate path of the required party relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: K31

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 5.01-5.03, Sect. II, Par. 28.06

SD-25016-01 B4

BIN NAME**O*NO-ROUTE-RLY****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Route - Relay: The route relay operate path is as follows: ground is applied from a code point through either class-of-service relays, screening relays, or access code relays. Battery is applied through the windings of a 10 ohm route series relay and can also go through screening relay; it will therefore be necessary to refer to office records to determine what the operate path of the relay is.

DESCRIPTION OF CIRCUIT FAILURE

This failure indicates that the route relay did not operate. Check the operate paths of the route relay as determined by office records.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: J20

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 55.10, Sect. III, Par. 8.00

SD-25016-01 B30

BIN NAME

O*NO-S

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Sleeve Outgoing Trunk: After the office secondary of the office link and connector frame has operated in series with the C relay, the crosspoints of the switch are closed. This, in turn, extends the ground through to the trunk S lead. When the office primary hold magnets have operated, the ground that operated this magnet shunts the C relay and it releases. With the C relay released and the AC1 relay released and all the switch train holding magnets operated, a circuit is closed for operating the S relay.

DESCRIPTION OF FAILURE

This failure indicates that the S lead from the office link and connector circuit was not grounded. Check that the switch select magnet of the office link and connector frame has operated. Check operate path of the C relay. See CD Sec. II, Par. 26.02 for method of operation of the C relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2
SC1: M28

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.03
SD-25016-01 B45

BIN NAME**O*NO-S1K****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-S1 Lead Check: OPTION IO—When the S relay operates (for operate information see CD, Par. 26.02 of Sect. II), it extends the S1 lead ground to the winding of the S1K relay. The operated S1K completes part of the release path of the marker. The S1K relay is operated through contacts of the two-party test and check relay of (Fig. AQ) when option HV is furnished. The PT1 and PT3 relays of (Fig. AQ) both operate when a call is originated by a tip-party customer, and an ANI trunk is used to route the call. Neither relay PT1 nor PT3 operate if a ring-party customer originates an ANI call or on a tip-party, non-ANI call. The PTK1 relay operates as a check that the tip part indication is registered in the ANI trunk. When the S relay operates, the S1 lead ground is extended through the normal contacts of relay RP1 and operate contacts of relays PT1, PT2, and PTK1. When option KH (mfr disc) is furnished, the TP1 relay operates the S1K relay.

On tip-party, non-ANI calls, the S1K relay path is through the normal contacts of both PT1 and PT3 relay. If a call is originated by a ring-party customer, the party check feature for ANI is not used. In this case, the S1K check path is extended through relay TP1 normal and relay RP1 operated to operate relay S1K.

DESCRIPTION OF FAILURE

This failure indicates that the S1 lead of the outgoing trunk circuit has not been grounded by the operation of the office secondary switch. Check if the S relay operated in the marker. Check operate path of the S1K relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: M30

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 27
SD-25016-01 B50

SECTION 216-600-301

BIN NAME

O*NO-SL

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Sleeve District Junctor: When the district link and connector frame secondary holding magnet operates, the ground that operates this magnet shunts the A relay which releases. With this relay released, the AC1 relay released, and all the holding magnets of the switch train are operated, a circuit is closed for the operation of the SL relay.

DESCRIPTION OF FAILURE

The failure indicates that the SL lead from the district link and connector circuit was not grounded by the operation of the district link primary switch select magnet. Check the SL relay operate path. Check the operate path of the A relay. (See CD Sect. II Par. 26.02 for method of relay operation.)

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: W28

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.03

SD-25016-01 B45

BIN NAME**O*NO*SL—LW.OP****DESCRIPTION OF CIRCUIT OPERATION**

OM—Sleeve District Junctor: When the sender recycle feature is provided and any of the AR- punchings (Fig. 55) are cross-connected to the overflow route relay as an alternate route, option LW and AT wiring in (Fig. 8) provides for canceling the TC lead signal to the district on third trial recycle calls with TC charge. On third trial calls, the original route relay and relays TC1 and TC may operate before relay AR3 and AR4 operate, to release the route relay and TC relay. The TC1 relay, if operated, remains locked. The release of relay TC with the OV relay operated, operates the NC1 relay. With LW option, the TC1 relay releases and the district is set in no-charge condition.

DESCRIPTION OF FAILURE

The failure can be caused by the operation of both the NC1 and TC1 relays opening the operate path of the SL relay. Check for false ground on the TC1 relay locking path since only the NC1 relay should be operated at this time.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: W28

REFERENCE DOCUMENTS

CD-25016-01 Sect II, Par. 46.04

SD-25016-01 B1, B2, B45

BIN NAME

O*NO-SN

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Sender Number: When the CIA relay in the marker is operated, it applies ground on the SNG lead to the originating marker connector circuit. The ground on the SNG lead through the operated connector relays in the originating marker connector operates the SN- relay in the originating trouble indicator circuit. The operated SN- relay causes one of the SN- numbers to be printed out on the exception report, indicating which of the senders have been seized. This failure cannot generate an exception report. However, this information should be printed out on the exception report whenever the marker calls in the originating trouble indicator frame.

DESCRIPTION OF FAILURE

This failure indicates that the SN- relay in the trouble indicator did not operate, check the ground path from the marker through the marker connector to the trouble indicator circuit.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: 07

REFERENCE DOCUMENTS

SD-25016-01 B66

CD-25018-01 Sect. III, Page 6

SD-25018-01 B02

SD-25035-01

BIN NAME**O*NO-SR****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Sender Release: When the TK relay operates and the district link and connector is connected, the AK and AK1 relays operate, and a trunk is selected; the TKE relay is released, and a path is closed to operate the SR relay.

DESCRIPTION OF FAILURE

This failure is an indication that the sender release checking circuit did not close to permit the operation of the SR relay. Check the operation of the TK, AK, and AK1 relays and if the TKE relay released.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: R36

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 15

SD-25016-01 35A0

SECTION 216-600-301

BIN NAME

O*NO-ST1-ST2

DESCRIPTION OF CIRCUIT OPERATION

OM—Start Marker Function One and Two: The CK1 and CK3 relays, having operated, indicate that the F, D, A, and miscellaneous registers have properly functioned and, in turn, operated the CK4 relay. Operation of the CK4 relay opens the locking path of the CK1 and CK3 relays. When at least one recording relay in each chain releases, the CK1 and CK3 releases operating the CK6 relay. Ground through the operated contacts 1 and 2B of CK6, and normal contacts 1 and 3B of MRL relay, operates the ST1 and ST2 relays.

DESCRIPTION OF FAILURE

The ST1 and ST2 relays did not operate due to a failure in transmitting information between the subscriber sender and the originating marker. (The sender causes those leads which represent the desired information to be grounded, plus all other leads in the sender which are not required; for this particular call, thus, all leads between the subscriber sender and originating marker are grounded.) Check the CK relays operated; check operate path of the ST- relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2
SC1: U18, Q18

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 2, 12.06, 16
SD-25016-01 B35

BIN NAME**O*NO-SW-SL****DESCRIPTION OF CIRCUIT OPERATION**

OM—NO-Switch or Sleeve District Junctor: The operated A and C relays release the AC and AC1 relays which were previously operated from off-normal ground. The released AC relay closes the district S lead to ground from the front contact of the AK1 relay through the back contacts of the S and SL relays. This ground causes the operation of the district secondary and office primary hold magnets, each of which, in turn, extends the ground to the district link and connector, and office link and connector; respectively, the district primary and the office secondary hold magnets should also operate if not already operated in series with the A and C relays.

DESCRIPTION OF FAILURE

This failure indicates that the district link and connector primary switch hold magnet was not operated, and that the SL relay did not operate. Determine if the A relay has operated. If not, check for a false ground on the negative side of the A relay; check if the HMT1 relay operates, and check the SL lead from the district junctor for ground.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: Y30:2-W28

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 26.02
SD-25016-01 B44
SD-25031-01

SECTION 216-600-301

BIN NAME

O*NO-TCK

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Talking Charge Check: The TC relay is operated in series with the route relay. The operated TC relay causes the TC1 relay to be operated; this sets the district junctor in the proper charging condition. When an idle trunk and channel has been found, the AC relay will release and the locking ground from the district is extended over the TC lead through a back contact of the AC relay to operate the TCK relay.

DESCRIPTION OF FAILURE

This failure indicates that the talking charge checking relay has not operated. Check if the AC relay has released (this relay indicates that a channel has been selected). Check that the district junctor has functioned properly and that ground was returned on the TC lead.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: P28

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 29

SD-25016-01 B55

BIN NAME**O*NO-TK****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Transmitting Check: The TK relay is provided to check that the transmission leads between the marker and the sender have continuity. When, and only when, the proper combination of leads and windings of these relays are grounded, a path may be traced through the proper combination of OB, OG, CR, and CL relays, the check relay circuits of Fig. AM, AQ, 39, N, or O, 65, 70, and AT, if provided, to the winding of the TK relay causing the TK relay to operate.

DESCRIPTION OF FAILURE

This failure indicates that the sender release checking circuit did not close through the transmitting relays to operate the TK relay. Check to determine if the proper combination of OB, OG, LR, CL and etc relays operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: S29

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 11.59-11.61

SD-25016-01 B33

SECTION 216-600-301

BIN NAME

O*NO-TK1

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Transmitting Check Auxiliary: Relay TK1, opt. IK, is provided to check that only one RA- relay operates during a call. Ground under control of relay ST2 is extended through an RA- relay operated, the remaining RA- relays normal, and the 7DG and SKP relays to operate relay TK1. If a call is originated where none of the RA- relays are required to operate, the control ground from relay ST2 is extended through relay RA1-7, 7DG, and SKP normal to operate relay TK1.

DESCRIPTION OF FAILURE

This failure indicates that the sender release checking circuit through the route auxiliary and transmitting relay associated with MF outpulsing and ANI is not closed through. If more than one RA- relay operates, or if the TK1 relay operate path is open due to a dirty contact, relay TK1 fails to operate. Failure of relay TK1 to operate results in a subsequent failure of relay TK to operate.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: N30

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 11.60, 11.61

SD-25016-01 B34

BIN NAME**O*NO-TKE****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Trunk End: When the ST1 relay operates, it closed ground through the normal contacts of the KEL0-KEL9, KOL0-KOL9, KER0-KER9, KOR0-KOR9, and BK relay which operates the TKE relay.
Note: The TKE relay remains operated until a trunk is selected.

DESCRIPTION OF FAILURE

This failure indicates that the TKE relay did not operate. Check that no trunk select relay is falsely operated and that the ST1 relay has operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: W21 & K34

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17.10
SD-25016-01 B41

SECTION 216-600-301

BIN NAME

O*NO-TL-

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Trunk Level: Ground is applied to the TL punching through the contacts of the R- (route) relay operated and the normal (or back) contact of relay G1-4, ST4, TW1, if provided, SDT, and MRL. Punching TL is cross-connected to one of the TL0-14 punching.

DESCRIPTION OF FAILURE

This failure indicates that the lead to the outgoing trunk level relay was not grounded. Check to see that the TL relay path is not opened, due either to a dirty contact or the false operation of one of the following relays: G1-4, ST4, TW1, and if equipped, the SDT or MRL.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: D22

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 17
SD-25016-01 B38

BIN NAME**O*NO-TPK****DESCRIPTION OF CIRCUIT OPERATION**

OM—No-Tip Party Check: With the TP1 relay operated, and with the district junctor and district link and connector connected, and while an idle trunk and channel are being selected, the AC relay remains operated. The TP lead from the district junctor and through the district link and connector is connected through the front contacts of the TP1 and AC relay to ground. This operates a relay in the district junctor which locks when the sender has been given a normal release signal. The AC relay releases after an idle channel has been found, and the ground that locks the district junctor relay is returned over the TPE lead operating the TPK relay.

DESCRIPTION OF FAILURE

This failure indicates that the TPK relay did not operate. Check that the AC relay is released. (This released, indicates that a channel has been selected.) Check that the district junctor has functioned properly and TP lead continuity.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: T27

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 28.02

SD-25016-01 B52

SECTION 216-600-301

BIN NAME

O*NO-ZCK

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Zone Check: One relay, ZA or ZJ, is operated in series with the route relay to set the zone registration common control circuit in position to impose the required charge on the calling customer. When the zone charge condition has been registered in the multiple registration circuit, ground is connected to the ZL lead and the ZL relay operates. This removes ground from one of the following leads ZA through ZJ that is in use and transfers this lead to the winding of the ZCK relay which should now operate to ground that is locking the zone charge relay in the multiple registration circuit.

DESCRIPTION OF FAILURE

This failure indicates that the ZCK lead was not grounded, since one of the ZA through ZJ, ZR and ZL relays was operated. The problem is due to either contact 1 and 2T of ZL, or 4 and 5T of ZA through ZJ relays not making contact. Or, it could be a problem in the zone registration common control circuit.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: J18

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 32

SD-25016-01 B2

BIN NAME**O*NO-ZL****DESCRIPTION OF CIRCUIT OPERATION**

OM—No - Zone Lead: One of the relays, ZA or ZJ, is operated in series with the route relay to set the zone registration common control circuit in the position to impose the required charge on the calling customer. When the zone charge condition has been registered in the multiple registration circuit, ground is connected to the ZL lead and the ZL relay operates.

DESCRIPTION OF FAILURE

This failure indicates that the zone charge check lead was not grounded. This is due either to the zone charge condition not being registered in the multiple registration circuit, or the ground not being applied to the ZL lead from the registration circuit.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 32.01
SD-25016-01 B55

SECTION 216-600-301

BIN NAME

O*NO-ZR

DESCRIPTION OF CIRCUIT OPERATION

OM—No-Zone Registration: When the CIA relay in the originating marker operates, ground on the ZR lead to the zone registration common control circuit operates the TI relay in this circuit. The operated TI relay closes the ZR leads to operate a ZR relay in the originating trouble indicator, indicating which one of ten zone registration circuits was selected by the zone registration common control circuit.

DESCRIPTION OF FAILURE

This failure indicates that the ZR relay in the originating trouble indicator was not operated due to either the ZR lead in the marker not being grounded, TI relay in the common control circuit not operating, or a ZR relay in the trouble indicator not operating.

Note: This condition does not bring in the OTI, but the OTI is called in by some other defect.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 32
SD-25016-01 B66
CD-25018-01 Sect. III, Par. 2.1
SD-25018-01 B5 Fig. 27

BIN NAME**O*OF-LOCK-OUT****DESCRIPTION OF CIRCUIT OPERATION**

OM—Office Frame—Lock Out: When the ST1 relay operates, it closes battery through a resistance and the back contacts of the ST3 relay, back contacts of the G1-4 relay, and front contact of the operated route relay through the cross-connection to the office link and connector circuit to operate MP- relay in a pair of office frames.

DESCRIPTION OF FAILURE

The failure indicates that there is a continuous battery cross on an office ST lead holding operated the associated marker preference MP or E relays, locking all other markers out of the affected pair of office link and connector frames. If the trouble indicator does not indicate the cross is in the marker, insulate the proper contacts of the office frame TR- relay to determine in which direction the battery cross exists. If toward the marker, open the ST lead at various points in order to segregate the cross.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: F25

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 12
SD-25016-01 B31
BSP 216-635-301

SECTION 216-600-301

BIN NAME

O*OF-SHUNT-PATH

DESCRIPTION OF CIRCUIT OPERATION

OM—Sender OF Relay Shunt Path: When the TW lead is grounded, information is transmitted to the sender that the call is to be routed through crossbar tandem, an office tandem selector, or through full selector tandem equipment. This is done for the purpose of extending the time-out period for a stuck sender or to avoid immediate release of a subscriber sender when no assignment has been made and the call is abandoned. This lead is also grounded on certain attendant class calls for the purpose of short circuiting the winding of the sender OF relay on trunks that normally return reverse battery during trunk test. The XSL relay protects the SL lead to the district link and connector circuit from false grounds when the circuit is normal.

DESCRIPTON OF FAILURE

This failure indicates that there is a false ground on the SL lead for a two-wire office route to the tandem office. Check the SL lead between the marker and the district link and connector.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: F25

REFERENCE DOCUMENTS

CD-25016-01 Sect. II Par. 11.11, & 50.26
SD-25016-01 B19 B45

BIN NAME**O*OPEN-M-LEAD****DESCRIPTION OF CIRCUIT OPERATION**

OM—Open-M Lead: When the district link and connector circuit has closed the leads between the marker and the district junctor, the MRA relay should operate over the MR lead through the district junctor to resistive positive potential from the message charging system. After a channel has been selected by the marker, causing the MC relay to release, the MR relay will then operate from ground through contacts of the MRA and AC relays.

DESCRIPTION OF FAILURE

This failure indicates that the M lead from the district junctor is open. Check lead continuity; check that relay AC is normal and that MRA relay is operated.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: S27

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 64.05

SD-25016-01 B54

SECTION 216-600-301

BIN NAME

O*OTI-TEST

DESCRIPTION OF OPERATION

OM—Originating Trouble Indicator Test: Facilities are provided in the trouble indicator circuit for making routine tests of the marker circuit and taking records of marker failure. The two principle functions of the originating trouble indicator are:

- (a) Taking a record of information set up on the originating marker when it fails to complete its functions in the allowed time.
- (b) Setting up test calls in an originating marker circuit, allowing it to perform the functions, and taking a record of resulting translating and progress of the test call.

DESCRIPTION OF FAILURE

This is not a failure but a test call.

NORMAL SEQUENCE OF OPERATIONS

REFERENCE DOCUMENTS

CD-25016-01
SD-25016-01
CD-25018-01
SD-25018-01

BIN NAME

O*RL-FAILURE

DESCRIPTION OF CIRCUIT OPERATION

OM—Release Failure: The RL lead from the originating marker to the originating trouble indicator is grounded only on test calls or when a trouble record is being taken.

DESCRIPTION OF FAILURE

This failure indicates that a ground is on the RL lead from the sender or originating marker connector which has not released or from a false ground on the RL lead.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 16
SD-25016-01 B36

SECTION 216-600-301

BIN NAME

O*RP1&TP1

DESCRIPTION OF CIRCUIT OPERATION

OM—Ring- and Tip-Party Call: On two-party lines, the sender passes the information, on which customer to charge for the call, to the marker. When the CK1 and CK3 relays release, the CK6 relay operates; if the TP is operated from the sender, the TP1 relay operates and locks under control of the ST1 relay. On a ring-party call, the RP1 relay operates and locks under control of the ST1 relay.

DESCRIPTION OF FAILURE

This failure indicates that both the ring RP1 and tip TP1 relays operate. Only one of these relays should be operated on any two-party call. This error can be due to a short in the operate or locking path of these relays.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: Z21

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 5

SD-25016-01 B2, B4

BIN NAME**O*SDR-TST-FR****DESCRIPTION OF CIRCUIT OPERATION**

OM—Sender Test Call: On sender test circuit calls, the sender puts in a bid for a marker by placing ground on the ST lead to operate the SDT1 or SDT2 relays; these relays operated place ground on the operate lead of the SDT relay. With the TK relay normal, this relay operates. **Note:** A false ground on the ST lead, to the SDT- relays in the marker, from the sender can also cause the SDT relay to operate on other than test calls.

DESCRIPTION OF FAILURE

This failure is due to one of the following:

- (a) Sender test call fails; marker decoding OTI will be seized; SDT lamp will light.
- (b) If a nonsender test call fails the marker decoding stage, but the ST lead is falsely grounded, this call also looks like a sender test call failure.

However, if a sender test has not been made and calls have been binned, check the ST lead for false ground.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 58.00
SD-25016-01 B67

SECTION 216-600-301

BIN NAME

O*TB5

DESCRIPTION OF CIRCUIT OPERATION

OM—All Trunks Busy: If all permanent signal trunks are found busy, the TB5 relay operates. With all permanent signal trunks busy and with the PSI relay operated, the DL relay will operate and call in the originating trouble indicator.

DESCRIPTION OF FAILURE

All permanent signal trunks are busy.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 37.06
SD-25016-01 B30

BIN NAME

O*USER-DEF-A

DESCRIPTION OF CIRCUIT OPERATION

OM—User Defined Data Point: Utilization of the data points is up to the discretion of the individual telephone company. These “user defined” points allow most locally designed nonstandard arrangements to be completed with the standard ATA System.

DESCRIPTON OF FAILURE

A nonstandard data point was grounded.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01

SD-25016-01

SECTION 216-600-301

BIN NAME

O*USER-DEF-B

DESCRIPTION OF CIRCUIT OPERATION

OM—User Defined Data Point: Utilization of the data points is up to the discretion of the individual telephone company. These “user defined” points allow most locally designed nonstandard arrangements to be completed with the standard ATA System.

DESCRIPTION OF FAILURE

A nonstandard data point was grounded.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01

SD-25016-01

BIN NAME**O*CROSS-CHECK-ER****DESCRIPTION OF CIRCUIT OPERATION**

OM—Cross-Check-Error: The X- relays detect false grounds on many of the leads over which connection is made to the associated circuits. These relays are connected when the circuit is normal or when busy in service, except on the leads that are actually in use. The operation of any of these X- relays, whether the circuit is service busy or not, will cause the operation of either the xx1 or xx2 relay. The trouble indicator is called in to take a record of the trouble whenever a X- relay operation occurs in the originating marker.

DESCRIPTION OF FAILURE

This failure indicates that a cross was detected and the originating trouble indicator was called to take a record and no cross indication was found: Check for the false operation of the (xx1), (xx2), or (DL) relay in the originating marker.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 48

SD-25016-01 See Sh. A7 for X- relay locations

SECTION 216-600-301

BIN NAME

O*X-LA-EA

DESCRIPTION OF CIRCUIT OPERATION

OM—X - Local or Extended Area: When the marker is arranged to operate with subscriber senders arranged for recycle or code compression, the marker receives ground from the subscriber sender over the LA, EA, and CC leads. The sender receives the information as to which lead or leads are to be grounded from the recycle circuit. The LA lead is grounded on calls where the prefix 1-1 is not dialed or on calls to foreign areas when the NPA is not compressed. The EA lead is grounded if translation of the individual office codes in the extended area is required; this occurs when the subscriber sender registers a 1-1 prefix before the office code.

DESCRIPTION OF FAILURE

This failure indicates that the LA or EA leads were both grounded. Ground through the marker circuits from the sender should have been applied to either the LA or EA, not both leads. If the transmission leads are correct, check that the code compressor is functioning properly.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: U13

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 8.02

SD-25016-01 B14, C9

BSP 216-258-501

BSP 216-258-505

BIN NAME**O*X-M-LD-TO-BAT****DESCRIPTION OF CIRCUIT OPERATION**

OM—Cross on M Lead to Battery: When the district link and circuit has closed the leads between the marker and the district junctor, the MRA relay should operate over the MR lead through the district junctor to resistive positive potential from the Message Charging System. After a channel has been selected by the marker, causing the AC relay to release, the MR relay will then operate from ground through contacts of the MRA and AC relay.

DESCRIPTION OF FAILURE

When the B relay operates, the MRK relay operates and, in turn, operates the MR1 relay. If the MRK relay does not release, the MR lead is crossed false -48V battery.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: V25

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 64.05

SD-25016-01 B54

SECTION 216-600-301

BIN NAME

O*X-ON-M-LEAD

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross on the M Lead: When the district link and connector circuit has closed the leads between the marker and the district junctor, the MRA relay should operate over the MR lead through the district junctor to resistive positive potential from the Message Charging System. After the channel has been selected by the marker, causing the MC relay to release, the MR relay will then operate from ground through contacts of the MRA and AC relays.

DESCRIPTION OF FAILURE

If two or more MR leads are crossed together or to -48 battery, anywhere from the marker to the Message Charging System, the XMR relay will operate in series with the MRA relay.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E2

SC1: V25

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 64.05

SD-25016-01 B54

BIN NAME**O*X-ROUTE-RELAY****DESCRIPTION OF CIRCUIT OPERATION**

OM—Cross on Route Relay: The ground to operate the route relay comes from a particular code dialed, the route is determined by class of service and other considerations. The battery to operate the route relay is furnished through the winding of the relay used to set up a proper charge and transmission information in the district junctor.

DESCRIPTION OF FAILURE

Cross route relay failure is indicated by more than one route relay operating as indicated by the operation of the routing information X-relays. Check for short or cross on both the ground operate lead and the battery supply.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: H18

REFERENCE DOCUMENTS

CD-25016-01 Sect. III, Par. 8
SD-25016-01 B30

SECTION 216-600-301

BIN NAME

O*XC

DESCRIPTION OF CIRCUIT CHANGE

OM—Cross Change: The XC relay is a marginal relay and will not operate when energized in series with one of the TC1, OT1, KP1, ZA1 through ZJ1, TW1, or OOV1 relays, but will operate if energized in series with any two or more of these relays.

DESCRIPTION OF FAILURE

The XC relay is energized in series with any two or more of the following relays: TC1, OT1, KP1, ZA1 through ZJ1, TW1, or OOV1.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sec. II, Par. 50.20

SD-25016-01 B1A0

BIN NAME**O*XCH****DESCRIPTION OF CIRCUIT OPERATION**

OM—Cross on the Sleeve or Line Sleeve Leads: This indicates a false ground on the S or LS lead to the district junctor and connector circuit, prior to the operation of STX relay. It also protects the line sleeve lead to the office link and connector circuit and the primary winding of the C relay. This is a standing ground test.

DESCRIPTON OF FAILURE

A false ground is on the S or LS lead to the district link and connector circuit or on the LS lead to the office link and connector.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 50.22

SD-25016-01 B44CO

SECTION 216-600-301

BIN NAME

O*XDC

DESCRIPTION OF CIRCUIT OPERATION

OM—Crossed on the DC Lead From the Originating Marker Connector Circuit: This relay protects the DC lead to the sender against false grounds until the district frame has been seized.

DESCRIPTION OF FAILURE

False ground on the DC lead to the sender before the district frame has been seized.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 50.28

SD-25016-01 B29

BSP 216-607-301

BSP 216-613-301

BSP 216-617-301

BSP 216-629-301

BSP 216-631-301

BSP 216-635-301

BIN NAME**O*XDC-XSM1****DESCRIPTION OF CIRCUIT OPERATION**

OM—False Ground or Cross on the DC Lead: XSM1 Crossed Select Magnets District Link and Connector Circuit: The XDC relay protects the DC lead to the sender against false grounds until the district frame has been seized. The XSM1 relay is marginal and will not operate in series with one district primary select magnet, but will operate in series with two select magnets. It operates XSM2 relay which prevents operation of the hold magnets and operates the DL relay.

DESCRIPTION OF FAILURE

XDC- Check for false ground or cross on the DC lead from the marker through the marker connector to the subscriber sender.

XSM1 - This failure indicates that two primary select magnets energized on the district link and connector frame. Check for a short or cross on the district link and connector frame. Check for a short or cross on the district link and connector primary switch select magnet.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 50.28, 50.29

SD-25016-01 B29, B46

BSP 216-629-301

BSP 216-613-301

SECTION 216-600-301

BIN NAME

O*XDF1

DESCRIPTION OF CIRCUIT OPERATION

OM—Crossed Contact on a Marker DF Relay: This relay checks for short circuits on the contacts of relay DF0 through 19 while the marker is idle. Such a short circuit might cause seizure of an unwanted district frame when the desired district frame is busy. This would result in the grounding of the DC lead to the sender, false operation of district F and LC relays, and select magnets on the busy district frame. The XDF1 relay also makes a standing ground test on SB lead from the office link and connector.

DESCRIPTION OF FAILURE

Crossed contact on a marker DF relay, or a false ground on the SD lead from office link and connector frame.

~~NORMAL SEQUENCE OF OPERATION~~

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 50.33
SD-25016-01 B9 E3

BIN NAME

O* XK

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Lead Detection: This relay protects leads SSA and SSB from the district link and connector and leads CK, SSA, SSB, SPE, SPO, NSE, and NSO from the office link and connector against false grounds when the originating marker circuit is idle.

DESCRIPTION OF FAILURE

The failure indicates a false ground on the PSA, PSB, SSA, SSB, NO-, SP-, or CK leads to the office link and connector circuit, or on the SSA or SSB leads from the district link and connector, on the coil of either the CK or BK relays.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Sect. II, Par. 50.21

SD-25016-01 B37A0, B29A0, B47E2

SECTION 216-600-301

BIN NAME

O*XLCE

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Lead Detection: This relay protects the LC- leads used by the even office link and connector circuit against false shorts and grounds.

DESCRIPTION OF FAILURE

This failure indicates one or more falsely grounded LC- leads to the even-office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 50.14
SD-25016-01 B42E4

BIN NAME

O*XLCO

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Lead Detection: This relay protects the LC- leads used by the odd office link and connector circuit against false shorts and grounds.

DESCRIPTION OF FAILURE

This failure indicates one or more falsely grounded LC- leads to the odd office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 50.14
SD-25016-01 B42E4

SECTION 216-600-301

BIN NAME

O*XLG

DESCRIPTION OF CIRCUIT OPERATION

OM—Crossed Locking Ground: When Figure B and Option WK are provided, the operation of relay KR also operates relay XLG in Figure B. With relays MT and MT1 operated, all of the locking leads from the recording relays are connected through a resistance and a contact on the MT1 relay to the winding of relay XLG. Should any of the locking leads be falsely grounded, relay XLG will be held operated, thereby locking the indicator out of service until the trouble ground is cleared. Relay XLG is a slow release relay to ensure holding the operate ground closed to the winding of relay MT and MT1 until after relays GD and GD1 have fully released. If the register relay locking leads are free of false grounds, and relay XLG releases, releasing relays MT and MT1 to restore the trouble indicator to normal.

DESCRIPTION OF FAILURE

This failure indicates a ground cross on one of the register relay locking leads. (The TI is made busy to all markers and cannot be started for marker test until the trouble is cleared.) All other indications are superfluous, until the XLG indicator is cleared.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25018-01 Sect. II, Par. 1.14
SD-25018-01 B12D7

BIN NAME

O*XOF

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Office Frame Relays: This relay is marginal and will not operate in series with one office relay but will operate if two or more of these relays are operated.

DESCRIPTION OF FAILURE

This failure indicates that the windings of two or more office frame relays in the originating marker are energized due to a cross or false ground on the OK- leads to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.16

SD-25016-01 B31D1

SECTION 216-600-301

BIN NAME

O*XRL

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Check RL and TRL Leads: The XRL relay has two windings and is arranged for marginal operation to prevent relay operation on a lockup over the TRL lead as TR3 and TR4 relays operate. One winding checks the RL lead against false grounds while the other protects the TRL lead against false grounds. Relay XRL provides a locking circuit for the DF relay to retain a record of the district frame number if the ground which operates XRL also causes the sender to disconnect from the marker.

DESCRIPTION OF FAILURE

This failure indicates a false ground on the RL or TRL leads of the originating marker. A falsely grounded RL lead is indicated by the presence of a lighted RL and XRL lamp.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.31
SD-25016-01 36F0

BIN NAME

O*XS

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross S Lead Office Link: The XS relay protects the S lead to the office link and connector circuit against false ground until the HMT1 relay releases just prior to energizing the hold magnets of the office link and connector circuit.

DESCRIPTION OF FAILURE

This failure indicates a false ground on the S lead to the outgoing trunk that was selected by the originating marker.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.27

SD-25016-01 B45B4

SECTION 216-600-301

BIN NAME

O*XS1

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross S1 Lead Office Link: The XS1 relay protects the S1 lead to the office link and connector circuit against false ground when the circuit is normal.

DESCRIPTION OF FAILURE

This failure indicates a falsely grounded S1 lead to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.24
SD-25016-01 B39G3

BIN NAME**O*XSL****DESCRIPTION OF CIRCUIT OPERATION**

OM—Cross SL Lead District Link and Connector Circuit: The XSL relay protects the SL lead to the district link and connector circuit from false grounds until relay BK operates following successful trunk selection and channel test.

DESCRIPTION OF FAILURE

This failure indicates a false ground on the SL lead to the district link and connector circuit.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Par. 50.26

SD-25016-01 B45 F4

BSP 216-609-301

BSP 216-625-301 ✓

BSP 216-625-609

BSP 216-637-301

BSP 216-637-609

SECTION 216-600-301

BIN NAME

O*XSL-XDC

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Sleeve Lead to the District Link and Connector Circuit: This relay protects the SL lead to the district link and connector circuit from false grounds when the circuit is normal. False Ground on the DC Lead to the Subscriber Sender: This XDC relay protects the DC lead to the sender from false grounds until the district frame has been seized.

DESCRIPTION OF FAILURE

XSL - Check the sleeve lead to the district link and connector for false ground.

XDC - Check for false ground or cross on the DC lead from the marker through the marker connector to the subscriber sender.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Sect. II, Par. 50.26, 50.28

SD-25016-01 B29, B45

BSP 216-609-301

BSP 216-625-301

BSP 216-637-301

BIN NAME

O*XSM

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross SML and SMR Leads to Office Link and Connector Circuit: The XSM relay protects the SML and SMR lead to the even and odd office link and connector circuit from false grounds when the circuit is normal.

DESCRIPTION OF FAILURE

This failure indicates a false grounded or crossed SML or SMR lead to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.25
SD-25016-01 B46D0
BSP 216-609-301
BSP 216-625-301
BSP 216-637-301

SECTION 216-600-301

BIN NAME

O*XSM1

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Select Magnets District Primary: The XSM1 relay is marginal and will not operate in series with one district primary select magnet, but will operate in series with two or more select magnets. It operates XSM2 relay which prevents operation of the hold magnet and operates the DL relay causing the OTI to be seized.

DESCRIPTION OF FAILURE

This failure indicates that two or more primary select magnets are energized on the district frame.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.29
SD-25016-01 B46 H0
BSP 216-611-301

BIN NAME

O*XSS

DESCRIPTION OF CIRCUIT OPERATION

OM—XSS: Cross SS Relay Office Link and Connector Circuit: The XSS relay will operate if more than one SS relay in the office link and connector circuit is connected to the SMR or SML leads of the even or odd office link and connector circuit. CS 334

DESCRIPTON OF FAILURE

This failure indicates that two or more SS relays are operated in the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.17

SD-25016-01 46FO

SECTION 216-600-301

BIN NAME

O*XSS-XOF

DESCRIPTION OF CIRCUIT OPERATION

OM—XSS-XOF: Cross SS Relays and Cross Office Frame Relay: The XSS relay will operate if more than one SS relay in the office link and connector circuit is connected to the SMR or SML leads of the even and odd office link. The XOF relay is a marginal relay and will not operate in series with one office relay but will operate if two of these relays are operated.

DESCRIPTION OF FAILURE

This failure indicates that two or more SS relays are operated, and the windings of two or more office frame relays in the originating marker are energized due to a cross or false ground on the OK lead to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.16 & 50.17
SD-25016-01 B31D1 & B46F0
BSP 216-635-301

BIN NAME**O*XSS-XS****DESCRIPTION OF CIRCUIT OPERATION**

OM—XSS-XS: Crossed SS Relays and Crossed S Lead in the Office Link and Connector Circuit. The XSS relay will operate if more than one SS relay in the office link and connector circuit is connected to the SMR or SML leads of the odd or even office frames. The XS relay protects the S lead to the office link and connector circuit from false grounds until the HMT1 relay has released just prior to energizing the hold magnets.

DESCRIPTION OF FAILURE

The operated XSS relay indicates that two or more SS relays are operated in the office link and connector circuit. The XS relay indicates that a false ground is on the S lead to the outgoing trunk that was selected by the originating marker.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Par. 50.17 & 50.27
SD-25016-01 B45B4 & B46F0

SECTION 216-600-301

BIN NAME

O*XTC

DESCRIPTION OF CIRCUIT OPERATION

OM—XTC: Cross Talking Charge Leads: The XTC relay protects the TP, TC, and OT2 leads to the district link and connector circuit against false grounds.

DESCRIPTION OF FAILURE

This failure indicates a false ground on the TP, TC, or OT lead.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.23
SD-25016-01 52E1

BIN NAME

O*XTD

DESCRIPTION OF CIRCUIT OPERATION

OM—XTD: Cross Toll Diversion Lead: The XTD lead protects the TDV lead to the sender circuit from false grounds. Such a false ground on lead TDV would block the marker by shunting relay TDVK on those calls requiring toll diversion and would send a toll diversion signal to the associated senders on all calls.

DESCRIPTION OF FAILURE

The failure indicates a false ground on the TDV transmitting lead to the originating marker.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.34
SD-25016-01 B32D4

SECTION 216-600-301

BIN NAME

O*XTL

DESCRIPTION OF CIRCUIT OPERATION

OM—XTL: Cross Trunk Level Relays: The XTL relay will operate if any two of the (TL0 through 14) relays are energized.

DESCRIPTION OF FAILURE

This failure indicates that two or more (TL-) relays in the marker have operated.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.12
SD-25016-01 B38B2

BIN NAME**O*XTL1****DESCRIPTION OF CIRCUIT OPERATION**

OM—XTL1: Cross Trunk Level Leads: There are three relays, (XTL1 through XTL3) for this purpose. One of these relays is furnished for each ten TL leads to the office link and connector circuit. If a ground should be connected to one of the idle TL leads, the XTL1 through XTL3 relays will operate. If a false short should occur between one of the TL leads in use, and one not in use, the XTL1 through XTL3 relays will operate. The operation of these relays causes the XTL1 lead to the originating trouble indicator to be grounded.

DESCRIPTION OF FAILURE

This failure indicates a falsely grounded TL lead to the office link and connector circuit.

NORMAL SEQUENCE OF OPERATION**REFERENCE DOCUMENTS**

CD-25016-01 Par. 50.13

SD-25016-01 B38E3 & B31G4

SECTION 216-600-301

BIN NAME

O*XX1-CC

DESCRIPTION OF CIRCUIT OPERATION

OM—XX1-CC: Master Cross Relay and Code Compression: If the LA lead is grounded and one or more of the CC- relays is operated, relay XX1 operates. Also if three-out-of-five, CC- or ACC- relays operate, the XX1 lead is grounded. The CC- lamps are used on a two-out-of-five basis to indicate the compressed code leads are grounded to the translator selector part of the originating marker when code compression and 6-digit translation is provided. They are also used in conjunction with the LA & EA lamps to indicate access code information.

DESCRIPTION OF FAILURE

Crossed LA lead or if incorrect number of CC- relays operate either more or less than the required two-out-of-five the XX1-CC's lamps will light.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1
SC1: Y13

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.6 & 50.10
SD-25016-01 B15A4, D4; B14F3; B16A8; B15A9; B61B0

BIN NAME**O*XX1-LA-EA****DESCRIPTION OF CIRCUIT OPERATION**

OM—XX1: Master Cross Relay in Originating Marker Operated: LA - Local Area: EA - Extended Area: With compressed code operation, the grounded LA lead indicates to the marker that the call is to a subscriber in the local (home) area or to a foreign area outside the number plan area. The grounded EA lead indicates to the marker that the call is to a subscriber in the foreign area of the number plan area.

DESCRIPTION OF FAILURE

If both EAR & LAR relays operate, the XX1 relay in the originating marker will operate. The operation of XX1 relay results in the LA, EA, and XX1 indication.

NORMAL SEQUENCE OF OPERATION

SD-25016-01 E1

SC1: Y13

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.5

SD-25016-01 B14A5, B14D5, B61D0

SECTION 216-600-301

BIN NAME

O*XX1-XT

DESCRIPTION OF CIRCUIT OPERATION

OM—XX1: Cross Master Relay-XT Crossed Transmitting Leads: These relays protect the transmitting leads to the sender against false shorts or ground. These relays are connected to all the transmitting leads except those leads actually in use in transmitting information to the sender. Should two of these transmitting leads be shorted when one of the leads is in use and the other is not, the ground through the winding of the OBA, etc, relays that is in series with the lead in use will back up through the short over the lead not in use and operate the XT or XX1 relay. A false ground on any one of the idle transmitting leads will operate the XT relay and/or XX1. A false ground on a used transmitting lead will cause the OBA, etc, relays which is in series with that lead to fail to operate, and the circuit will block because the path for operating the TK relay will not be closed; therefore, the SR relay cannot operate and give the sender a release signal.

DESCRIPTION OF FAILURE

This failure indicates that one or more transmitting leads to the sender are falsely grounded. The operated XT relay operates the XX1 relay.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.03

SD-25016-01 B24G7, B61A0

BIN NAME

O*XZ

DESCRIPTION OF CIRCUIT OPERATION

OM--XZ: Crossed Zone Leads: The XZ relay protects the zone charge leads to the multiple registration common control circuit and leads to the district link and connector circuit against false grounds.

DESCRIPTION OF FAILURE

This failure indicates a falsely grounded zone charge lead.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.18

SD-25016-01 B55 C0

SECTION 216-600-301

BIN NAME

O*XZS

DESCRIPTION OF CIRCUIT OPERATION

OM—Cross Zone Start and OFL Leads: This relay protects the zone start and zone overflow leads to the multiple registration common control circuit against false grounds.

DESCRIPTION OF FAILURE

This failure indicates a falsely grounded zone charge lead or the operation of more than one of the charge KP1, TC1, and OT1 relay.

NORMAL SEQUENCE OF OPERATION

REFERENCE DOCUMENTS

CD-25016-01 Par. 50.19
SD-25016-01 B55F0

CROSSBAR SYSTEM
NO. 1
TROUBLE INDICATOR CIRCUIT
ORIGINATING

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit is changed to provide for operation with originating markers, in offices equipped with local AMA, that are arranged to signal the subscriber sender on the AID lead that automatic identification of outward dialing from the PBX station served by the 101 ESS group control equipment is required.

B. CHANGES IN APPARATUS

B.1 Added

In Fig. 18

(AIOD) Relay U1248
(AIDK) Relay U1248
(AIOD) Lamp 2Y
(AIDK) Lamp 2Y

D. DESCRIPTION OF CIRCUIT CHANGES

Sheet C1C2

D.1 Changed "WR" option shown on leads to (TP) key to read "WQ".

Sheet C1C3

D.2 Relays (AIOD), (AIDK) and lamps (AIOD), (AIDK) are added to Fig. 18 and designated "WT" option.

Sheet C1C4

D.3 Option "WT" added to option used table.

Sheet C1C7

D.4 (AIOD) and (AIDK) relays added to circuit requirements table.

Sheet C1C8

D.5 AIOD and AIDK leads added to Fig. 19K.

Sheet C1C10

D.6 Reference to "WT" option added in note 12C.

D.7 Note 157 added.

F. CHANGES IN CD SECTIONS

F.1 Added under 4. Connecting Circuits.

4.9 Miscellaneous relay rack circuit, No. 1 on tandem office - SD-25440-01.

F.2 Under Description of Operation

Under 5. Principal Parts of Circuits Added.

5.39 Recording relays added in Fig. 13 to indicate (1) the AID relay operated in marker when class of service indicates this is a 101 ESS PBX station call (AIOD relay) and (2) the AID lead is grounded to the sender to indicate that automatic identification of outward dialing is required (AIDK relay).

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2319-GJT-LF-EH

CROSSBAR SYSTEMS
NO. 1
TROUBLE INDICATOR CIRCUIT
ORIGINATING

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit is changed:

- (a) To provide for operation with originating markers, in offices equipped with local AMA, that are arranged to ground lead "ODN" as a signal to MF out-pulse the calling number.
- (b) To provide for testing the outgoing trunk overflow traffic registers from the originating trouble indicator.
- (c) To provide a flexible means for checking any leads in the originating marker for the presence of battery or ground at the time the originating trouble indicator is connected.

B. CHANGES IN APPARATUS

B.1 Added

In Fig. 15
(TP-TOV) Key C1AG

In Fig. 18
(ODN) Relay U-1248
(ODN) Lamp 2Y

In Fig. 19
(EXBG) Relay U368
(EXBG) Lamp 2Y
(EXBG) Key 552A
(XTOV) Relay U368
(XTOV) Lamp 2Y

- B.2 Superseded Superseded By
C1EJ Key "WP" C1AG Key "WQ" Option,
Option, Fig. 15 Fig. 15

D. DESCRIPTION OF CHANGES

Sheet - 0101

- D.01 Reference to "WO", "WP", "WR", and "WS" options is made in Note 120.
- D.02 (TP-TOV) key added and shown as Option "WQ".
- D.03 (TP) key shown as option "WP" (Mfr. Disc.)
- D.04 Note 109 is shown: (Mfr. Disc.)

Sheet - 0102

- D.05 (TP-TOV) key added as Options "WQ" and "WR" in Fig. 15.

Sheet - 0103

- D.06 The (ODN) relay and lamp is added to Fig. 18 and designated as Option "WO".
- D.07 The (EXBG) relay, lamp and key are added to Fig. 19 and designated as Options "WS".
- D.08 The (XTOV) relay and lamp added to Fig. 19 and designated as Option "WR".

Sheet - 0104

- D.09 Options "WO", "WP", "WQ", "WR" and "WS" are added to Options Used table.
- D.10 Option "WP" added to Note 134.

Sheets - 0105, - 0106, - 0107

- D.11 Pages 1 to 20 (CIRCUIT REQUIREMENT TABLES) changed to Issue 47.

Sheet - 0107

- D.12 ODN relay ("WO" option), XTOV relay ("WR" option), EXBG relay ("WS" option) and Test Note 1 added to Circuit Requirement table - Page 20.

Sheet - 0108

- D.13 Lead "ODN" added to Fig. 18K.
- D.14 Lead "TOV" added to Fig. 15K.
- D.15 Lead "EXBG" added to Fig. 19K.

Sheet - 0110

- D.16 Notes 153, 154, 155, 156 added.

F. CHANGES IN DESCRIPTION OF OPERATION

- F.1 Add the following to Section 3. FUNCTIONS:
3.224 The (TOV) key is provided for testing the outgoing trunk overflow traffic registers.
- F.2 Add the following to Section 5. PRINCIPAL PARTS OF CIRCUIT:

5.37 Recording relay to indicate ODN signal to the subscriber sender for MF outpulsing of the calling number, Fig. 18.

5.38 Recording relay (EXBG) for indicating the presence of battery or ground on the extra maintenance punching (EXBG) in the originating marker.

F.3 Add the following to the list of lamps in paragraph 6.5 Information Recorded:

LAMP DESIG	IN FIG.	
(ODN)	18	- Indicates information transmitted to the sender by the originating marker on calls on which MF outpulsing of the calling number from an auxiliary sender is required.
(XTOV)	19	- Indicates a false ground on lead "TOV" to the originating marker.
(EXBG)	19	- Indicates a battery or ground condition [depending on the position of the (EXBG) key] on the extra lead maintenance test punching (EXBG), in the originating marker, Fig. 19.

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F.4 Add to Section 7. TESTING ORIGINATING MARKER CIRCUITS:

7.12 Testing for Battery or Ground on Marker Extra Maintenance Punching

The EXBG punching in the originating marker may be connected to any lead for test purposes by means of a test cord. With the EXBG key in the normal position the lead in the originating marker is tested for presence of ground. Turning the (EXBG) key clockwise prepares the circuit to operate relay (EXBG) if battery is connected to the lead under test. Operation of relay EXBG causes the EXBG lamp to light.

7.13 Test for Outgoing Trunk Overflow Traffic Register Operation

The outgoing trunk overflow traffic registers may be tested from the originating trouble indicator by holding the nonlocking (TOV) key operated while a test call is being made from the indicator circuit. Operation of this key grounds lead "TOV" to the marker which functions to cause operation of a particular outgoing trunk overflow traffic register and a marker peg count register. A ground on lead "TOV" when the TOV key is normal operates relay XTOV and lights the XTOV lamp.

CROSSEBAR SYSTEMS
NO. 1
TROUBLE INDICATOR CIRCUIT
ORIGINATING

CHANGES

A. CHANGED AND ADDED FUNCTIONS

A.1 This circuit is changed to provide for operation with originating markers that are arranged to screen codes in a recycled numbering plan area for the prefix-digit "one" when both 6-digit translation (recycle) and access code features are provided.

With this new feature, in addition to grounding 2 of the 5 CC- leads and either the EA or LA lead for all calls, the PD1 lead is grounded for recycled codes have a prefix-digit "one".

B. CHANGES IN APPARATUS

B.1 Added:

Fig. 41

(PD1)	U 1224 Relay
(PD 1)	2Y Lamp
(PD 1)	C1G Key

D. DESCRIPTION OF CHANGES

Sheet -0100

D.1 Figs. 41 and 41K added to Sheet Index.

Sheet -0101

D.2 (PD1) Key Added

D.3 Fig. 41 added in Note 120.

Sheet -0102

D.4 Connection to Fig. 41 is added to Fig. 15.

Sheet -0104

D.5 Fig. 41 added to Options Used Table.

Sheets -0105, -0106, -0107

D.6 Pages 1 to 20 (Circuit Requirement Tables) Changed to Issue 46.

Sheet -0107

D.7 Fig. 41 added to Circuit Requirement Table - Page 20.

Sheet -0108

D.8 Cabling Diagram 41K added.

Sheet -0110

D.9 Connection To Fig. 41 is added to Fig. 39.

D.10 Fig. 41 Added

D.11 Note 151(C) added

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7.205 Selecting and Seizure of the Originating Marker	20	functions and then taking a record of the resulting translation and progress of the test call.
7.206 Originating Marker Operation When Handling a Test Call	21	(c) Setting up test calls in several originating marker circuits (4 maximum of same marker group) simultaneously to test by a comparison that the cross-connections for these circuits are alike.
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7.209 Recording, Disconnection of Trouble Indicator, and Release of Originating Marker on Bridged Markers Test	23	2.1 This circuit is used only with local circuits in the same building.
7.210 Display of Recorded Information	23	3. FUNCTIONS
7.211 Release of Trouble Indicator and Start of Another Test Call	24	3.1 Trouble Indicator Functions
7.03 Key Pulsing Sender Calls Requiring No Marker Functions But Only Decoder Functions	24	3.101 Prevents more than one originating marker from being connected to it when summoned by two or more simultaneously.
7.04 Recording an All-Trunks Busy Condition	24	3.102 Takes a record of various information from the originating marker, district link, and originating marker connector circuit after it is engaged by an originating marker circuit.
7.05 Reorder Release Signal	24	3.103 Indicates the number of the originating marker from which the record was taken.
7.06 Recording When the Originating Marker Encounters a Message Register Check Failure, an All-Channels-Busy, or Trunk-Stolen-by-Panel Condition	25	3.104 After taking a record, signals the originating marker to transmit a trouble release to the associated sender and return normal, and then disconnects itself.
7.07 Test for False Ground on "DK" and "DK1" leads in the Marker	25	3.105 Starts an alarm to indicate that a record has been taken from an originating marker.
7.08 Test for the Toll Diversion Feature in the Originating Marker	25	3.106 When taking or holding a record from one originating marker it makes itself busy to all others and signals all those that summon it to transmit a trouble release to their associated sender and return to normal.
7.09 Test for the Automatic Number Identification Feature in the Originating Marker	25	3.107 Records the numbers of the originating markers that summon it during the time it is busy.
7.10 Immediate Release Feature	25	3.108 Displays a lamp record of all information recorded when the (LP) key is operated.
7.11 Remote Control	26	3.109 Returns to normal and makes itself available for selection when the release key is operated.
8. TROUBLE INDICATOR MAKE BUSY JACK	26	3.2 Test Call Functions
9. VERIFICATION OF GROUP START AND GROUP END	26	3.201 Office code, compressed code, class of service, district frame, extended area and prefix digit keys are provided for initiating all class of calls.
10. BRIDGED MARKERS TEST - COMPARISON OF ROUTE RELAY CROSS-CONNECTIONS	26	3.202 (DT) keys are provided for selecting any originating marker for testing.
11. TAKING EQUIPMENT OUT OF SERVICE	27	
12. ALARM INFORMATION	27	
1. PURPOSE OF CIRCUIT		
1.1 This circuit is for use in a crossbar office in connection with the originating marker circuits. Its principal purpose is to facilitate the location of troubles and to check certain cross-connections in the originating marker circuit by:		
(a) Taking a record of information set up in the originating marker when it fails to complete its functions in the allowed time.		
(b) Setting up test calls in an originating marker, allowing it to perform its		

3.203 An (ST) key is provided for starting the operation of the test circuit to seize the originating marker and to start the test call.

3.204 An (RL) key is provided for releasing the test and originating marker circuits, and wiping out the record, at any stage of the call.

3.205 An (MR) key is provided for simulating an open message register lead in order to test the ability of the marker to recognize this condition.

3.206 Before permitting a test call to be started it first determines that the trouble indicator is normal. The start key is ineffective until the trouble indicator is normal.

3.207 Tests to determine whether the selected originating marker is busy, and if busy, waits for it to become idle before connecting to it.

3.208 Gives preference to an originating connector that is attempting to seize a marker for a service call at the time the test call is started.

3.209 Makes the originating marker busy and starts the operation of its long interval timing relays by grounding its "DB" lead.

3.210 Makes the trouble indicator busy to all originating markers except the one to be tested

3.211 Upon seizing the originating marker, operates the test connecting relay in the originating marker circuit which closes the control leads between the two circuits and prepares the originating marker for receiving the test call.

3.212 Upon seizing the originating marker, operates the trouble indicator connecting relay in the originating marker which closes the receiving and transmitting leads to the trouble indicator recording relays.

3.213 Recognizes a signal from the originating marker that it is prepared to receive the test call and closes the office code, compressed code, class of service, district frame, extended area and prefix-digit transmitting keys which are operated prior to the start of the test call, thus simulating the connection of a sender by an originating marker connector circuit.

3.214 Prevents the trouble indicator alarm from being started while the circuit is handling and holding a record of a test call.

3.215 Simulates the (F) relay of a district junctor circuit, and a primary switch

hold magnet of a district link to enable the marker to complete its channel selections between the outgoing trunk and a district junctor circuit.

3.216 Simulates that part of a zone registration control circuit and district junctor circuit necessary to enable the marker to complete its charge and transmission functions, and to check its ability to perform these functions.

3.217 Starts the time measure relays in the originating marker by grounding its "TM" lead.

3.218 Arranges the originating marker to summon the trouble indicator to take a record when it successfully completes the normal functions for handling the test call, or if it encounters trouble to summon the trouble indicator when its time measure relays have completed the time interval allowed for handling the call.

3.219 Arranges the originating marker to summon the trouble indicator to take a record before releasing, if it encounters any condition that will cause it to attempt to release when completing the call such as all trunks busy, all channels busy, trunk seized by a panel selector, open message register lead, or a reorder in the case of a denied code.

3.220 Provides means for testing originating marker code translations by locking the code receiving and the code translation recording relays in the trouble indicator operated before disconnecting the code keys and the transmitting leads when the originating marker transmits a sender release signal.

3.221 Disconnects the office code, compressed code, class of service, district frame, extended area and prefix-digit transmitting keys together with the code receiving and transmitting leads when the originating marker transmits a sender release signal thus simulating the disconnection of a sender by an originating marker connector circuit.

3.222 Waits for a summons from the originating marker to take a record.

3.223 Records the condition of certain relays and leads in the originating marker to determine the progress of the test call, and then signals the originating marker to transmit a trouble release and return to normal.

3.224 Tests to determine that the originating marker has returned to normal, after which it releases the connecting relays and restores the marker to service.

3.225 Displays a lamp record of the information received from the originating marker when the (L) key is operated.

3.226 Releases the test circuit and all recording relays when the (RL) key is operated. When Fig. B and "WK" option is provided, checks the register relay locking leads for ground crosses at each release.

3.226 Provides means for testing the zone charge relays in the originating marker and its ability to function with the zone registration control and district junctor circuits for all charge and transmission conditions.

3.228 Provides means for simulating a zone device overflow condition by means of the (ZOF) key.

3.229 Tests for false ground on "DK" and "DK1" leads in marker.

3.230 Indicates when the indicator is seized because of operation of the marker short time out.

3.231 The (MR1-MR2) key is provided to test markers arranged to check for false opens and the connection of false battery to the "MR" lead.

3.232 The (GSE) key is provided to test "Group Start" and "Group End" cross connections for the associated route relay.

3.233 The (BM) jack associated with each marker circuit is provided to allow comparison of route relay cross-connections for as many as four markers in the same marker group at once.

4. CONNECTING CIRCUITS

4.1 Originating Marker Circuits - SD-25016-01.

4.2 Originating Marker Connector Circuits - SD-25035-01.

4.3 District Link and Connector Circuits - SD-25031-01.

4.4 Miscellaneous Circuit for Trouble Indicator Frame - SD-25063-01.

4.5 Zone Registration Common Control Circuit - SD-25320-01. M.R.

4.6 Alarm Transfer - SD-25885-01.

4.7 Alarm Sending Circuit - SD-95417-01.

4.8 3-digit Translator Connector - SD-96529-01.

DESCRIPTION OF OPERATION.

5. PRINCIPAL PARTS OF CIRCUITS

5.01 Control relays, Fig. 1 and Figs. A or B.

5.02 Preference chain control relays, Fig. 2, or Fig. 30.

5.03 Recording relays for indicating the district frame relay operated in the originating marker, Fig. 4.

5.04 Recording relays for indicating the office frame relay operated in the originating marker, Fig. 5.

5.05 Recording relays for indicating the office frame trunk level relay operated in the originating marker, Fig. 6.

5.06 Recording relays for indicating the channel relay operated in the originating marker, Fig. 7.

5.07 Recording relays for indicating the originating marker connector frame on which the originating marker connector associated with the originating marker being recorded, is located, Fig. 8.

5.08 Recording relays for indicating the particular originating marker connector on the connector frame, Fig. 21.

5.09 Recording relays for indicating the location of the sender in a sender frame group, Fig. 9.

5.10 Recording relays for indicating the district primary switch number on the district frame, and the number of the district primary switch level, Fig. 10, or 28. From this indication the district junctor circuit and the district secondary switch level will also be obtained.

5.11 Recording relays for indicating the (GS) 1 to 4 relays operated in the originating marker, Fig. 11.

5.12 Originating marker group indicating lamps, Fig. 12.

5.13 Recording relays for indicating the outgoing trunk selection relay operated in the originating marker circuit, Fig. 13.

5.14 M.R. keys and relays for simulating a district junctor and zone registration control circuit when testing an originating marker, Fig. 14. These keys provide means for testing the zone charge feature of the originating marker.

5.15 Keys for setting up the office code, compressed code, class of service,

district frame, extended or local area and prefix-digit information for a test call to simulate a sender, Fig. 15, 39 and 41.

5.16 Recording relays for indicating the information received by the originating marker from the sender, or test keys in the case of a test call, Fig. 16. This information consists of the office code, subscribers class of service, district frame, and whether an alternate route, overflow, tip party, extended or local area call.

5.17 Recording relays for indicating the charge and transmission relays operated in the originating marker and the checking relays operated in connection with these relays, Fig. 17.

5.18 Recording relays for indicating what transmitting leads to the sender are grounded, Fig. 18.

5.19 Recording relays for indicating the (X) relays operated in the originating marker, Fig. 19.

5.20 Recording relays for indicating the progress of a call through the originating marker, Fig. 20.

5.21 Recording relays for indicating the pattern relays operated in the originating marker, Fig. 22.

5.22 Recording relays for indicating the trunk subgroup, relay operated in the originating marker, Fig. 23.

5.23 Recording relays for indicating the "JC" lead to the district link and connector circuit grounded by the originating marker circuit, Fig. 24.

5.24 Recording and control relays for recording the conditions under which the originating marker releases, and for controlling the operation of the circuit when recording a test call, Fig. 25.

5.25 Recording relays for indicating the trunk subgroup advance relay, for trunk groups having exactly two subgroups, operated in the originating marker, Fig. 26.

5.26 M.R. recording relays to indicate the timing circuit engaged by the zone registration common control circuit, Fig. 27.

5.27 Relays for testing for false ground on "DK" and "DK1" leads of the marker, Fig. 29.

5.28 Recording relay to indicate when the indicator has been seized as a result of the operation of the short marker time-out, Fig. 33.

5.29 Recording relays to check (MI-) relays in marker, Fig. 34.

5.30 Key for setting up test of "Group Start" and "Group End", Fig. 35.

5.31 Jacks associated with each marker for setting up bridged marker test for comparison of route relay cross-connections.

5.32 Recording relays to indicate a Skip 3, Skip 2, or a 7-digit signal to the subscriber sender on direct distance dialed type of calls, Fig. 18.

5.33 Recording relays to indicate the correct setting of the party test and party check relays in the originating marker for offices with automatic number identification, Fig. 20.

5.34 Recording relays to indicate the compressed code leads grounded to the originating marker when six digit translation and code compression is provided, Fig. 39.

5.35 Recording relays to indicate number of the 3-digit translator used to translate the adjacent numbering plan area office code when such translators are common to a group of markers, Fig. 40.

5.36 Recording relay to indicate when the "FD1" lead is grounded to the originating marker for prefix-digit "one", Fig. 41.

6. TROUBLE INDICATOR CIRCUIT OPERATION

6.1 Seizure of Trouble Indicator and Connection to Originating Marker

The trouble indicator is arranged to serve either one or two groups of originating markers and will be summoned by any one of the originating markers which fails for any reason to complete its functions and release in a predetermined time, which is measured by the originating marker circuit.

The connection of all originating markers to the trouble indicator is controlled by a preference chain lock-out circuit, Fig. 2 or 30, which allows only one circuit to be connected at a time. This preference chain circuit consists of a (DS) relay for each originating marker and the winding of each relay connects to the "TIS" start lead of its associated originating marker circuit. An originating marker summons the trouble indicator by connecting battery to its "TIS" lead operating the associated (DS) relay. The (DS) relay in the first position in the preference chain has its winding connected directly to ground and may operate at any time. In operating, it opens the ground to all succeeding relays in the chain. However, any relay in the chain that is operated, except the first, will supply its locking ground to the winding of all preceding relays in the chain. Therefore, if the last relay in the chain is operated, all the (DS) relays may

be operated if their associated originating markers are summoning the trouble indicator. Each (DS) relay upon operating locks and attempts to operate the multicontact connecting relays in its associated originating marker. The circuit for operating these connecting relays starts at the last (DS) relay in the preference chain and progresses towards the first relay. Therefore, regardless of how many (DS) relays are operated, only the one nearest to the last position in the chain can operate its associated multicontact connecting relays by grounding its "CIA" lead. All other operated (DS) relays will remain locked until the trouble indicator transmits a release signal to all markers or if an originating marker times out before the trouble indicator transmits a release signal, then it will release its associated relay.

The operation of the (CIA) multicontact connecting relay in the originating marker by the (DS) relay having preference in the chain, (a) operates the (CIB), (CIC) (CID) and (CIF2) relays in the originating marker circuit, (b) operates the (CO1), (CO2) and (CO3) relays and (CO4) relay when provided, in the originating marker, (c) connects ground to the "TI" lead of the district link and connector circuit operating a relay that prepares paths for taking a record of the district primary switch and the district primary switch select magnet operated in connection with the call being handled by the originating marker (d) connects ground to the "FRQ", "SNG" and "CNG" leads of the originating connector circuit associated with the originating marker, and (e) operates a relay in the Zone Registration Control Circuit to prepare a path for taking a record of which timer is used.

The operation of the (CO1), (CO2), (CO3) and (CO4) relays (a) separates the originating marker transmitting leads to the sender and disconnects them from the trouble detecting relays so that these leads may be tested individually for false grounds and crosses, and (b) operates the (CIE) multicontact relay, (CIG) and (CII) U type relays and relay (CIH), when provided, which close the transmitting and receiving relays. The (CIA), (CIB), (CIC), (CID), (CIE), (CIF2) (CIG) (CIH) and (CII) relays together connect all of the trouble indicator recording leads to the originating marker.

When the options which provide relay (CIH) are wired in the marker, optional wiring "WI" provides indications that recording in the marker is complete. Lamps (TK) and (TK1) will be lit under these conditions.

6.2 Taking the Record and Disconnection from the Originating Marker

The operation of the (CID) multicontact connecting relay in the originating marker connects ground to the "DR" lead of

Fig. 2 or 30 operating the (DR) relay which locks under control of the (KR) relay in Fig. 1, and (a) prepares a path for lighting the (DR) lamp to indicate the particular originating marker from which the record was taken, (b) opens the ground from the (DL) lamp to prevent it from lighting, (c) starts the trouble indicator alarm, and (d) operates the (RT) relay. The (DL) relay in Fig. 2 or 30, associated with the originating marker from which the record is being taken, will operate and lock but is prevented from lighting its (DL) lamp by the operation of the associated (DR) relay. However, any other originating markers that summon the trouble indicator while it is busy will operate their respective (DL) relays which in turn will light their associated lamps to indicate the originating markers that failed without a record having been taken.

The operation of the (RT) relay operates the (RT1) and it in turn operates (HD) relay. The (HD) relay locks under control of the (DR) relay, operates the (GD) and (GD1) relays which lock all of the operated recording relays, and releases the (RT) and the (RT1) relays. The (RT) and (RT1) relays are a slow release and slow operate combination which are primarily for the purpose of timing the period during which the recording relays operate, after which the trouble indicator disconnects from the originating marker and signals it to transmit a trouble release to the associated sender and return to normal.

The release of the (RT1) relay, (a) connects ground through the operate contacts of the (HD) relay operating the (RD) relay which locks to the (GD) relay and operates the (RM) relay, and (b) disconnects ground from the "CIA" lead releasing the (CIA) relay in the associated originating marker. The (CIA) relay in turn releases the (CIB), (CIC), (CID), (CIE), (CIF2), (CIG), (CIH) and (CII) relays in the originating marker, thereby disconnecting all of the recording leads. The operation of the (RM) relay connects ground to the "TIB" leads of all originating markers operating the (TIB) relay in each circuit. The operation of the (TIB) causes the originating marker from which the record was taken, as well as any other originating markers that are calling for the trouble indicator, to transmit a trouble release to their associated senders and return to normal.

In addition, the (TIB) relay in each originating marker opens the "TIS" lead of its circuit releasing all the operated (DS) relays in the trouble indicator preference chain circuit. The (RM) relay remains locked under control of the (RL) key thus causing all originating markers that summon the indicator while it is holding a record to give an immediate trouble release. The (RML) relay Fig. 3, when furnished for a

second group of originating markers, operates in parallel with the (RM) relay.

The (HD) relay locks operated under control of the (DR) relay associated with the originating marker from which the record was taken and this relay in turn is locked under control of the (RL) key. The (HD) relay holds the (GD) and (GD1) relays operated and these relays lock all of the recording relays operated thus holding the record until the (RL) release key is operated. In the meantime the alarm is in operation and the (DR) lamp when lighted will indicate the originating marker from which the record was taken.

During the time that the multicontact connecting relays are operated in the originating marker, the recording leads are closed to the trouble indicator. Each recording lead is associated with a relay or a lead in the originating marker, and if grounded, operates the associated recording relay in the trouble indicator circuit. Before the connecting relays are released and the recording leads are disconnected, all operated recording relays are locked operated by the operation of the (GD) and (GD1) relays as already described. Each recording relay prepares a path for lighting a lamp which is designated so as to identify the particular function associated with its recording lead in the originated marker. In a few cases, the operation of the recording relay opens the lighting circuit of the lamp as it is necessary to use the absence of ground on the recording lead to indicate the operation of a relay in the originating marker. The lamps are lighted to display the recorded information by operating the (LP) key which locks and operates the (LP) relay, also the (LP1) relay when furnished. These relays connect battery to all of the recording lamps and those which are grounded as a result of the operation, or nonoperation in some cases, of the recording relay will light thus displaying the information taken from the originating marker.

6.3 Release of Trouble Indicator

6.31 To wipeout the record and return the trouble indicator to normal, the (RL) key is momentarily operated, operating the (KR) relay which locks under control of the operated (HD) relay. The operation of the (KR) relay opens the locking circuits of the (DR) and (DL) relays and they release. The release of the (DR) relay extinguishes the originating marker group lamp (if furnished), and releases the (HD) relay. If there are any (DL) relays operated other than the one associated with the originating marker from which the record was taken, their associated (DL) lamps will be extinguished when the relays release. The (DL) lamp associated with the (DL) relay of the marker from which the record was taken will not have been lighted, the ground having

been removed by the operation of the associated (DR) relay. The release of the (HD) relay, (a) releases the (GD), (GD1), (RD), then (RM) and (RM1) relays and the (LP) relay if the (LP) key is locked in the operated position and (b) reconnects ground to the (DS) relay chain circuit for operating the (CLA) multicontact connecting relays in the associated markers. The release of the (LP) and (LP1) relays extinguishes the display lamps, and the release of the (GD) and (GD1) relays release all of the recording relays returning the circuit to normal. The release of the (RM) and (RM1) relays releases the (TIB) relays in all originating markers thereby removing the busy condition from the trouble indicator.

6.32 When Fig. B and Option "WK" is provided, the operation of relay (KR) also operates relay (XLG) in Fig. B.

Relay (XLG) operated:

- (a) Opens the operate path for relay (ST) to prevent a test restart until relay (XLG) releases,
- (b) holds relay (RM) operated,
- (c) provides operate ground for relays (MT) and (MT1),
- (d) closes a path to light lamp (XLG) if any register locking leads are grounded when relays (MT) and (MT1) are operated.

Relays (MT) and (MT1) do not operate until relays (GD) and (GD1) release since the operated condition of either relay (GD) or (GD1) shunts down both relays (MT) and (MT1). When relays (GD) and (GD1) have released, relays (MT) and (MT1) can operate. With relays (MT) and (MT1) operated, all of the locking leads for the recording relays are connected directly to lamp (XLG) and also through a resistance and a contact on the (MT1) relay to the winding of relay (XLG). Should any of the locking leads be falsely grounded, lamp (XLG) will light and relay (XLG) will be held operated, preventing any further starts of the trouble indicator until the trouble ground is cleared. Relay (XLG) is a slow release relay to insure holding the operate ground closed to the windings of relays (MT) and (MT1) until after relays (GD) and (GD1) have fully released. If the register relay locking leads are free of false grounds, lamp (XLG) does not light and relay (XLG) releases, releasing relays (MT) and (MT1) to restore the trouble indicator to normal.

6.4 Alarms Transferred to Alarm Receiving Center

When the alarms are transferred to an Alarm Receiving Center the Alarm Transfer Circuit grounds lead "OM1" (XK Wiring Only) operating relay (RM). Relay (RM) operated

makes the Trouble Indicator busy to all markers. With "XM" wiring the trouble indicator is not made busy when alarms are transferred. When a (DL) relay operates one of leads 01 to 08 (XN) option or 04 to 09 (XO option) is grounded to the Alarm Sending Circuit which permits identification at the maintenance center of marker 0-7 in trouble. The (DL) relays which have been locked up to the (KR) relay can be released by the operation of a key in the Alarm Receiving Circuit which grounds lead "AR1" operating relay (KR).

6.5 Information Recorded

The originating markers are arranged to decode a second call while completing the marker functions for a preceding call. Therefore, there may be one or two calls in the originating marker at the time the trouble indicator is summoned. In order to allow a second call to enter the originating marker before the first call has been completed, the originating marker is arranged to release the decoding apparatus when it advances into the second stage, that is, when it transmits a release signal to the sender and the originating marker connector releases. Therefore, when the trouble indicator is summoned after the originating marker has advanced to the second stage, the record taken will not show the code and class of service information that was recorded on the receiving relays, or the sender, originating connector and connector frame numbers for this call. However, if another call has entered the first stage of the originating marker this information will be recorded for the second call.

Whether one or two calls are being handled by the originating marker can be determined from the (CKG) and (MS) lamps in Fig. 20. The (CKG) relay operates and prepares a path for lighting its associated lamp when there is ground on the "CKG" lead

of the originating marker indicating that a sender is connected. The (MS) relay operates and prepares a path for lighting its associated lamp when there is ground on the "MS" lead of the originating marker indicating that a call is being handled in the marker stage.

When the (CKG) lamp lights and the (MS) lamp does not it indicates:

- (a) That a sender is connected.
- (b) That there is only one call being handled by the originating marker.
- (c) That the trouble encountered by the originating marker is in the decoder stage.

When the (MS) lamp lights and the (CKG) lamp does not it indicates:

- (a) That a sender is not connected thru a marker connector circuit.
- (b) That there is only one call being handled by the originating marker.
- (c) That the originating marker has advanced to the marker stage.
- (d) That the trouble encountered is in the marker stage of the originating marker.

When the (CKG) and (MS) lamps both light it indicates:

- (a) That there are two calls being handled by the originating marker.
- (b) That a sender is connected thru the marker connector circuit.

The following is a list of the lamps that display the recorded information, together with their indications:

LAMP DESIG.	IN FIG.	
(2L)	34	-Indicates operated two line entry relay. (AMA)
(3DT) 0-3	40	-Indicates the number of the 3-digit translator used in the decoder portion of the marker usage.
(7DG)	18	-Indicates information transmitted to the sender by the originating marker on calls in which 7 digits are dialed and M.F. outpulsing from an auxiliary sender is required.
(A), 0,1,2,4,5 (B), 0,1,2,4,5 (C), 0,1,2,4,5	16	-These lamps indicate the number of the office code received by the originating marker from the sender. When there are more than one of these lamps lighted for any one digit, the numbers are added to determine the digit number.

LAMP DESIG.	IN FIG.	
(D), 0,1,2,4,8	16	-These lamps indicate the class of service as received from the senders. There are various arrangements used in the sender with lamp indications as shown in class of service tables.
		-The "D1" to "D4" leads when not grounded, in the sender; are connected to the "CK3" lead in all cases. If the marker should block in the code check part of the decoder stage all the "A", "B", "C", "D", "F", "AR", "OF", "PD1" and "TP" leads may be indicated as grounded.
(F), 0,1,2,4,5,10	16	-Indicates the district link frame number received by the originating marker from the sender. The numbers of the lighted lamps are added to obtain the district link frame number.
(A) (C)	20	-These lamps are controlled by the front contacts on the (A) and (C) relays in the originating marker circuit and either one or both lighted indicates a trouble condition.
(AK)	20	-Indicates that the "AK" lead from the district link and connector circuit has been grounded.
(AN)	20	-Indicates that the (AN) relay in the originating marker is operated to route calls to an announcement trunk on an overflow indication from the sender.
(ANI)	20	-Indicates an automatic number identification type call.
(AR)	16	-Indicates that an alternate route was requested by the sender. This lamp is also lighted on third trial calls.
(B)	20	-Indicates that the (B) relay in the originating marker is operated. Unless trouble is encountered, this relay is shunted down by the release of the (F) relay in the district junctor circuit.
(BK)	20	-Indicates that the district link and connector circuit has grounded the "BK" lead and that the (CK) and (BK) relays are operated in the originating marker circuit.
(BM)	37	-Indicates that at least one or all jacks associated with markers involved in a bridged markers test contain a 329A plug when the (ST) key is operated.
(CC) 0,1,2,4,7	39	-These lamps are used on a two-out-of-five basis to indicate the compressed code leads grounded to the translator selector part of the originating marker when code compression and six digit translation is provided. They are also used in conjunction with the EA and LA leads to indicate access code information to the marker. More than two (CC-) lamps lighted or any (CC-) lamps lighted with lamp (EC) also lighted are trouble indications.
(CF), 0-9	8	-Indicate the frame on which the originating marker connector circuit is located. There is one of these lamps for each originating marker connector frame in one group. Where there are more than one group of originating marker connector frames, the same numbered relays and lamps are used for like numbered connector frames in both groups.
(CH), LO to L9 and (CH), RO to R9	7	-Indicate the channel selection relay operated in the decoder marker, the district link secondary switch, and the office link primary switch.
(CHE)	20	-Indicates that the (BK), (CK) and (CHE) relays are operated in the originating marker circuit and that the (CH) channel selection relays in the originating marker are released.

LAMP DESIG.	IN FIG.	
(CK)	20	-Indicates that the "CK" lead has been grounded by the office link and connector circuit and that the (CK) relay is operated in the originating marker circuit.
(CKG)	20	-Indicates that a sender is connected.
(CL), 1,2,3,4,5	18	-These lamps indicate the class information transmitted to the sender by the originating marker circuit for the particular code received by the originating marker from the sender.
(CN), 0-2	21	-Indicate the originating marker connector on a particular frame. One per originating marker connector per one frame.
(CR), 1,2,3,4,5,6,7	18	-These lamps indicate the compensating resistance information transmitted to the sender by the originating marker circuit for the particular code received by the originating marker from the sender.
(CRL)	25	-All channels busy.
(DF), 0-19	4	-Indicates the district link and connector frame number as translated by the originating marker from the information received from the sender.
(DL)	2 or 30	-Indicates the originating markers that failed and were released without a record being taken, while the trouble indicator was busy. There is one of these lamps for each originating marker served by the trouble indicator.
(DK)	20	-Indicates that the "DK" lead to the district link and connector circuit is grounded.
(DR)	2 or 30	-Indicates the originating marker circuit from which the record was taken. There is one of these lamps for each originating marker in one group of originating markers. When there are two groups, the same lamps are used for like numbered circuits in both groups.
(DT3)	25	-Trunk selected by the marker was also seized by a panel selector before it could be made busy.
{EA} {LA}	16	-The (EA) lamp indicates that the "EA" lead is grounded to the originating marker and the (LA) lamp indicates that the "LA" lead is grounded. These leads may be used as follows: (a) To indicate a code in either the extended or local area when the prefix "one-one" is used to reach a single adjacent numbering plan area. (b) Together with the "PD1" lead, these leads are used as steering leads when the associated originating marker circuits are arranged for registration of both compressed codes and access codes.
(EC)	1	-Indicates that the marker has released, lights on test calls only.
(G), 0-11	23	-Indicate the trunk subgroup relay operated in the originating marker. These lamps indicate directly the trunk subgroup for trunk groups divided into four or more subgroups. For trunk groups divided into two or three subgroups, any even number indicates the 0 group and any odd number indicates the 1 group.

LAMP DESIG.	IN FIG.	
(G100) (GO) Decoder group	12	-Indicate the group of the originating marker from which the record was taken. These two lamps are only furnished when there are two groups of originating marker circuits.
(GS) 1-4	11	-Indicate trunk group selected. Indicate the route relay ground supply (GS) relays operated in the originating marker.
(GT1) (GT3)	26	-Indicate the trunk subgroup advance relay operated in the originating marker when the trunk group is divided into exactly two subgroups.
(JC) 0 to 19	24	-Indicate the "JC" lead that had been grounded by the originating marker to operate a (JC) relay in the associated district link and connector circuit. The (JC) relay which the (JC) lamp identifies, must be determined with reference to the cross-connection information.
(K) ELO to EL9 (K) OLO to OL9 (K) ERO to ER9 (K) ORO to OR9	13 or 31	-These lamps indicate the outgoing trunk selection relay that is operated in the originating marker circuit, and from this indication the office link <u>primary switch level</u> , and the office link secondary switch can be determined. For example any (O) lamp indicates the (O) office primary switch level and the (O) office secondary switch. There are 40 of these lamps, one for each similarly designated relay in the originating marker circuit.
(K4)	20	-Indicates a satisfactory check by the originating marker of the information received from the sender by the (A), (D), (F), (AR), (OF), (TP) and (PD1) receiving relays, and that the (CK4) relay is operated in the originating marker circuit.
(K5)	20	-Indicates a satisfactory check by the originating marker of the information received by the (B) and (C) receiving relays, and that the (CK5) relay is operated in the originating marker.
(M), 0 to 9	10 or 28	-The (M) lamp that is lighted indicates the select magnet operated on the district primary switch and, therefore, the district link primary switch level.
(M1), 0,1,2,4,7 (MIN)	34	-Indicates the (AMA) message index transmitting leads grounded in the marker.
(MIA) to (MIH) (MIJ), (MICK) and (MIPS)	17	-Indicates AMA transmitting relays operated in the marker.
(MR)	20	-Indicates that the (MR) relay is operated in the originating marker and therefore, a satisfactory check of the "MR" lead to the district junctor circuit.
(MR1)	25	-Message register lead open towards the district junctor circuit.
(MRL)	20	-Indicates that the (MRL) relay in the originating marker is operated and that trouble was encountered by the originating marker circuit which prevented it from returning to normal.
(MS)	20	-Indicates that the originating marker has released the sender and advanced to the marker stage.
(NC1)	17	-Indicates (NC1) operated in the marker for a no-charge condition.

LAMP DESIG.	IN FIG.	
(NM)	1	-Indicates a key pulsing test call which does not require marker functions in the originating marker.
(NSE)	20	-Indicates that the (NSE) relay is operated in the originating marker circuit. (Non-split even office frame)
(NSO)	20	-Indicates that the (NSO) relay is operated in the originating marker circuit. (Non-split odd office frame)
(OB) 1,2,4,5	18	-These lamps indicate the office brush information transmitted to the sender by the originating marker circuit for the particular code received by the originating marker from the sender.
(OBT)	18	-Indicates that the (OBT) relay is operated in the originating marker circuit for "High-five" incoming group when the pre-route relay is provided.
(OF)	16	-Indicates that an overflow trunk was requested by the sender.
(OF) 0 to 9	5	-Indicate the number of the office link and connector frame relay operated in the originating marker. Each lamp represents a pair of odd and even numbered frames and if an even numbered trunk lamp, Fig. 13 is lighted, the even frame of the pair is the one on which the trunk is located. If an odd numbered trunk lamp is lighted, the trunk is located on the odd frame of the pair.
(OG) 1,2,4,5	18	-These lamps indicate the office group information transmitted to the sender by the originating marker circuit for the particular code received by the originating marker from the sender.
(OT)	1,14	-Indicates operator's talking lead closed.
(OT1)	17	-Operator Talking Relay.
(P) 0 to 13	22	-Indicate the correspondingly designated pattern relays that are operated in the originating marker.
(PD1)	41	-Indicates that the "PD1" lead to the originating marker is grounded for prefix-digit "one" information in connection with the code compression and access code features.
(PTK)	20	-Indicates that the originating marker has transmitted tip party information to the outgoing automatic number identification trunk over the "S1" lead.
(PS1)	17	-Indicates relay (PS1) operated in the marker for a permanent signal call.
(RL)	25	-This lamp is lighted only for test calls, and indicates that the "RL" lead of the originating marker is grounded, thereby transmitting a sender release signal.
(RO)	25	-Reorder signal to an operator as a result of a denied code having been transmitted to the originating marker by a key pulsing sender. Where the senders and markers are arranged to disconnect from the district junctor without setting up a connection to the out trunk with all trunks busy, the "RO" lead is used to release the sender on 1st or 2nd trails. Failure of the sender to respond to this signal will result in an (RO) lamp.
(RP1)	17	-Ring Party Relay.

LAMP DESIG.	IN FIG.	
(S)	20	-Indicates that the "S" lead from the office link and connector circuit is grounded by the operation of the select magnet on the office secondary switch and that the (S) relay in the originating marker circuit should be operated.
(SD) (SD1)	18	-These lamps indicate the station delay information transmitted to the sender by the originating marker circuit for the particular code received by the originating marker from the sender.
(SGR)	16	-Indicates "SGR" lead grounded to originating marker for class of service information.
(SlK)	20	-Indicates that the "Sl" lead of the outgoing trunk circuit has been grounded by the operation of the office secondary switch and that the (S) relay has operated in the originating marker circuit.
(SK) 2-3	18	-Indicates information transmitted to the sender by the originating marker on calls in which M.F. outpulsing is required and either 2 or 3 of the dialed digits are skipped in outpulsing.
(SL)	20	-Indicates that the "SL" lead from the district link and connector circuit is grounded by the operation of the district primary switch select magnet and that the (SL) relay in the originating marker should be operated.
(SPE)	20	-Indicates that the (SPE) relay in the originating marker circuit is operated. Split even office frame.
(SPO)	20	-Indicates that the (SPO) relay is operated in the originating marker circuit. Split odd office frame.
(SN) 0-9	9	-Indicates the sender in an originating marker connector group. One lamp per sender per originating marker connector circuit.
(SO)	18	-Indicates that the marker has grounded the "SO" lead to indicate that the route contains no office selector. Skip office.
(SR)	20	-Indicates that the sender release checking circuit is closed to operate the (SR) relay and release the sender.
(SW)	10 or 28	-The (SW) lamp lighted indicates the district link primary switch and district link secondary switch level. Together with (M) they indicate the number of the district junctor circuit on the district frame. The (M) lamps indicate the units digit of the district junctor circuit number and the (SW) lamps the tens digit. For example, if the (M5) and the (SW8) lamps are lighted, it would indicate: District Primary Switch Level. -5 District Primary Switch, and District Secondary Switch Level. } -8 District Junctor Circuit -85
(TB5)	25	-All Trunks Busy.

These indications are taken directly from the district link and connector circuit connected to the originating marker at the time the record is taken..

LAMP DESIG.	IN FIG.	
(TC)	14	-Talking charge test relay operated.
(TC1)	17	-Indicates (TC1) relay operated to indicate the talking charge condition.
(TCK)	17	-Talking Charge and Operator's Talking Checking Relay.
(TDVK)	20	-Indicates that the (TDVK) relay in the originating marker is operated which operates in series with (TDVK) in the sender for the toll diversion feature.
(TK)	20	-Indicates that the sender release checking circuit is closed thru the transmitting relays to operate the (TK) relay in the originating marker circuit.
(TK1)	20	-Indicates that the sender release checking circuit through the route auxiliary and transmitting relays associated with M.F. outpulsing and automatic number identification is closed through. Also indicates if no route auxiliary or transmitting relays operate when the relay associated with these features remained normal.
(TKE)	20	-Indicates that the (TKE) relay in the originating marker is operated. This relay operates if all the trunk selection relays are released before an idle trunk is selected, and later releases. Therefore, this lamp will only light in case the marker fails and then blocks with its (TKE) relay operated.
(TL) 0 to 14	6	-Indicates the outgoing trunk level relay operated in the originating marker.
(TM6)	33	-Indicates operation of marker (TM6) relay after timeout.
(TP)	16	-Indicates a tip party call.
(TP1)	17	-Tip Party Relay.
(TP2)	14	-Tip Party Class Test Relay.
(TPK)	17	-Tip Party Checking Relay.
(TRL)	1	-Indicates Momentary Ground on the "TRL" lead.
(TW)	18	-For two wire office route.

The following lamps indicate which trouble relays are operated in the marker circuit. These relays are operated, and block the marker from completing the call when the leads they test are falsely grounded or crossed, in Figure 19, 39 and B.

LAMP DESIG.	
(SDT)	-Indicates a falsely grounded ST or SDT lead of the sender test circuit connector circuit.
(XC)	-Shows (XC) relay normal.
(XCH)	-Indicates a false ground on the "S" or "LS" leads to the district link and connector circuit or on the "LS" leads to the office link and connector circuit.
(XCL)	-Indicates that two windings of the (CL) transmitting relay are energized.
(XCR)	-Indicates that two windings of the (CR) transmitting relay are energized.
(XDC)	-Indicates a falsely grounded or crossed DC lead.

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- (XDF1) -Indicates a crossed contact on a marker (DF) relay.
- (XDK) -Indicates a falsely grounded "DK" or "DK1" lead.
- (XGE) -Indicates a cross or a false ground on the "GE" leads which will cause two or more (TG) OLO to OL9 or (TG) ORO to OR9 relays to operate.
- (XGS) -Indicates a cross or a false ground on the "GS" leads which will cause two or more (TG) ELO to EL9 or (TG) ERO to ER9 relays to operate.
- (XK) -Indicates a false ground on the "NS", "SP", or "CK" leads to the office link and connector circuit or on the "BK" lead to the district link and connector circuit.
- (XLCE) -Indicates a falsely grounded "LC" lead to the even office link and connector circuit.
- (XLCO) -Indicates a falsely grounded "LC" lead to the odd office link and connector circuit.
- (XLG) -Indicates a ground cross on one of the register relay locking leads. The trouble indicator is made busy to all markers and cannot be started for marker tests until the trouble has been cleared.
- (XOB) -Indicates that two windings of the (OB) transmitting relay are energized.
- (XOF) -Indicates that the windings of two or more office frame relays in the originating marker are energized due to a cross or false ground on the "OK" leads to the office link and connector circuit.
- (XOG) -Indicates that two windings of the (OG) transmitting relay are energized.
- (XRL) -Indicates a false ground on the "RL" or "TRL" leads of the originating marker. (XRL) relay opens the circuit to the (XDF1) lamp because the marker (XRL) locks (DF-) which operates (XDF1).
- (XS) -Indicates a false ground on the "S" lead to the outgoing trunk that was selected by the originating marker.
- (XS1) -Indicates a falsely grounded "S1" lead to the office link and connector circuit.
- (XSB) -Indicates that two windings of the (SB) transmitting relay are energized.
- (XSG) or (XO5) -Indicates that two windings of the (SG) transmitting relay are energized.
- (XSL) -Indicates a false ground on the "SL" lead to the district link and connector circuit.
- (XTD) -Indicates a false ground on the "TDV" transmitting lead in the originating marker.
- (XSM) -Indicates a false grounded or crossed "SML" or "SMR" lead to the office link and connector circuit.
- (XSM1) -Indicates two primary select magnets energized on the district frame.
- (XSS) -Indicates that two or more (SS) relays are operated in the office link and connector circuit.
- (XT) -Indicates that one or more transmitting leads to the sender are falsely grounded.
- (XTC) -Indicates a false ground on the "TP", "TC", or "OT" lead.

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- (XTL) -Indicates that more than one trunk relay is operated in the originating marker causing (XTL) relay of the marker to operate and block the call.
- (XTL1) -Indicates falsely grounded "TL" lead to the office link and connector circuit.
- (XX1) -Indicates the operation of the master (XX1) relay in the originating marker circuit.
- (XZ) -Indicates a falsely grounded zone charge lead.
- (XZS) -Indicates the operation of more than one of the charge (KP1), (TC1) or (OT1) relays.

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FIG.

- | | | |
|----------------|----|---|
| (Z) | 14 | -Zone charge test relay. |
| (ZA1) to (ZJ1) | 17 | -Zone Charge Relays. |
| (ZK) | 17 | -Zone Charge Check Lead. |
| (ZL) | 17 | -Zone Charge Locking Lead. |
| (ZO) | 17 | -Zone Charge Overflow Lead. |
| (ZR) | 27 | -The originating marker (CIA) relay operates a relay designated (T1) in the zone registration common control circuit. The (T1) relay closes the ZR leads, to operate a (ZR) relay of Fig. 27. The (ZR) relay has an associated lamp which indicates which one of ten zone registration circuits was selected by the zone registration common control circuit. |
| (ZS) | 14 | -The marker has grounded lead "ZS" as a zone start signal. |
| (ZCK) | 17 | -Zone Charge Check Relay. |

7. TESTING ORIGINATING MARKER CIRCUITS

7.1 General Description

The trouble indicator circuit in addition to taking records of service calls when summoned by an originating marker, is provided with means of originating test calls and recording the progress of the calls thru the originating marker circuit.

A set of keys is provided for setting up the office code and compressed code, class of service, and district frame information for all classes of calls that may be handled by the originating marker circuits in regular service. In addition, there are other keys for simulating conditions that may be encountered by a marker such as an open message register lead to the district junctor, and all zone charging devices busy (zone overflow).

For codes that call for zone charging a set of 10 keys is provided for checking the operation of the originating marker in selecting the proper zone charge for that particular code. Only one of these keys is operated for any one call and then the one

which will complete a circuit over that proper zone charge lead for the code that is set up on the transmitting keys.

To originate a test call the code, class of service and district frame transmitting keys are operated to prepare the circuit for transmitting the information for the call to the originating marker receiving relays. If it is a zone charge call the proper zone charge checking key is operated. The originating marker to be tested is then selected by operating a (DT) key. A (DT) key per originating marker is provided in the trouble indicator for selecting a particular originating marker, and an (ST) key for starting the test call. Only one (DT) key can be made effective at a time as the operating circuit for the (DT) relays is thru back contacts on all of the (DT) keys in series starting at the key associated with the first originating marker circuit. With Fig. 30 the (DT) relay operated locks and opens the operating circuit to all other (DT) relays, so that the test circuit remains connected to the marker until the test is completed or until the (RL) key is operated. Premature release of (DT) keys will be ineffective. The operation

of a (DT) key prepares the circuit for operating its associated (DT) relay when the start key is operated. If the trouble indicator is normal and all of its recording relays released, the operation of the (ST) key will operate the (ST) relay which in turn operates the (DT) relay associated with the operated (DT) key. The operation of the (DT) relay grounds the "DB" lead of the originating marker and starts a test to determine whether the originating marker is busy. If it is busy, the trouble indicator will wait until it becomes idle but will prevent another originating marker connector circuit from seizing it in the meantime. The test circuit allows a short interval of time after making the originating marker busy, during which a connector circuit can seize it, to prevent the possibility of a double connection.

When local office six digit translation is provided by means of code compression and recycle of the subscriber sender code register relays, it is necessary to be able to test with a particular 3-digit translator circuit. Provision is made to provide a (DTS) relay in the 3-digit translator connector circuit to operate in parallel with the (DT) relay for the first marker in the group, if a 3-digit translator, is plugged busy to traffic at the connector frame. With this arrangement, the 3-digit translator used for the marker test will be the one plugged busy if the compressed code key that is depressed causes the marker translator selector to direct the start signal to that 3-digit translator group.

When a marker is idle, the trouble indicator immediately prepares it for the test call and connects all of the test leads between the two circuits by grounding the "CIF1" lead. At the same time that the (DT) relay grounds the "DB" lead it also grounds the "T1B" lead to all other markers making the trouble indicator busy to all circuits except the one to be tested.

The originating marker signals the trouble indicator when it has connected the leads required for the test call by grounding the "MC" lead operating the (KY), (KY1), (KY2) and (KY3) (if used), relays which connect the transmitting leads to the originating marker; the zone charge and other test leads having been connected by the operation of the connecting relays in the originating marker.

The closure of the transmitting leads sets up the originating marker receiving relays similar to the connection of a sender by an originating marker connector circuit. The originating marker upon receiving the code information proceeds to perform its regular functions for handling a call and upon completion, assuming that no failure occurs, it calls for the trouble indicator to take a record of the call instead of

releasing as in the case of a service call. The originating marker is arranged to do this by the operation of its (DMT) relay which switches the release circuit so that instead of operating the marker release relay (MRL) at the completion of a call, it operates the (TR) relay in the trouble indicator circuit. The operation of this relay operates the (TR) relay in the originating marker which summons the trouble indicator to take a record.

In connection with the preparation of the originating marker for the test call, the (F) and (DPH) relays, Figure 1, are connected to leads in the originating marker to simulate the (F) relay of a district junctor circuit and the hold magnet of a district primary switch. This is necessary to enable the marker to proceed with its functions as the (LC) relay in the district link and connector circuit is not operated for a test call and the leads to the district primary switch hold magnet and to the (F) relay of a district junctor circuit are not closed. However, the originating marker does actually select an idle outgoing trunk, an office link and an office junctor, operating the hold magnets of the district secondary switch, office primary and secondary switches and the select magnets of the office primary and secondary switches closing the switch, crosspoints and connecting the sleeve lead from the selected outgoing trunk through the office primary and secondary switches to the hold magnet of the district secondary switch.

When the originating marker completes its decoding functions it operates its sender release relay (SR) grounding the "RL" which, in the case of a regular service call, causes the originating marker connector to be released and the sender disconnected. With a test call the grounding of the "RL" lead operates a relay in the trouble indicator circuit, as a result of which the trouble indicator locks the recording relays that have been operated over the originating marker transmitting and receiving leads, and then releases the (CIE) (CIG), (CIH) and (CII) connecting relays in the originating marker. The release of these relays disconnect the transmitting and receiving leads and remove ground from the "CKG" lead thus simulating the disconnection of a sender by an originating connector circuit. The release of the (CIE) connecting relay also releases the (KY), (KY1), (KY2) and (KY3), relays, disconnecting frame transmitting keys from the recording relays. The recording relays hold a record of the information transmitted to and received from the originating marker thus providing means for testing code cross-connections in the originating marker.

The disconnection of the receiving and transmitting leads permits the originating marker to continue with its marker functions. Upon completion of the call, instead

of operating its (MRL) relay and immediately restoring to normal, it operates the (TR) relay in the trouble indicator which in turn operates the (TR) relay in the originating marker. The operation of this relay operates the associated (DS) relay in the trouble indicator which in turn causes the trouble indicator to take a record of the call the same as described for trouble indicator operation except that the (CIE) and (CIH) connecting relays in the originating marker, which releases when the marker transmitted a sender release signal, are prevented from operating as the recording relays on the leads controlled by these relays are locked, holding a record of the code information which has been wiped out at this time by the originating marker. However, the other connecting relays in the marker are operated and the balance of the information set up is recorded, after which the trouble indicator transmits a release signal to the marker.

If the originating marker encounters trouble before completing its regular functions, it will call for a trouble indicator record when its timing relays operate the (TR) relay. If the originating marker encounters an all-channels-busy conditions, an open message register lead to the district junctor, or if the outgoing trunk that it selected is seized by a panel selector, or if for any other reason it attempts to release after transmitting a sender release signal, the trouble indicator will be summoned in the regular manner to take a complete record before the originating marker is released. If the originating marker encounters an all-trunks-busy condition, or if a reorder signal is given, the recording relays will be locked and the (CIE), (CIG), (CIH) and (CII) connecting relays will release similar to the release of an originating connector under like conditions with a service call. The same operation will take place on calls that require no marker functions in the originating marker.

After taking a record the trouble indicator will signal the originating marker to release and then disconnect itself thereby restoring the originating marker to service. However, the trouble indicator makes a test to determine that the originating marker has returned to normal before it disconnects itself. An (EC) lamp is lighted to indicate that the test circuit has disconnected and is holding a record which can be displayed by operating the (LP) key.

If it is desired to light the indicator lamps while the record is being taken the (LP) key may be operated in advance and it will lock in its operated position.

The test circuit and all recording relays are released by operating the (RL) key. The next call can then be started by operating the (ST) key. This key will be

ineffective until the trouble indicator is normal and all recording relays that were locked on the preceding call, are released.

7.2 Operation in Detail

7.201 Operation of Keys to Transmit Test Call Information to the Originating Marker, Fig. 15.

Before starting a test call the office code the compressed code, if necessary, the class of service and the district frame transmitting keys, must be operated and the (AR), (OF), (TP) or (PD1) key if an alternate route, overflow, tip party or prefix-digit "one" indication is to be transmitted to the originating marker receiving relays.

Where the (GS1) and (GS3) keys are provided the (GS1) key is operated to reach ground supply group 2, and the (GS3) and (AR) keys to reach group 4.

(a) Code Keys

There is one row of keys for transmitting each digit of the office code and one key must be operated for each digit. The code keys have numerical and alphabetical designations corresponding to dial designations. In the same row of keys with the A digit there is a zero operator key (OPR-0) and a permanent signal key (PS-1) which are operated when the originating marker is to be tested for this type of call.

When prefix "one-one" is used to reach a single adjacent numbering plan area, in addition to the code keys, the (EA) key ("V" apparatus of Fig. 15) must be operated if the code is for an office in the extended area or left normal for local area codes. The test circuit simulates the sender by grounding the "LA" lead for local area codes and the "EA" lead for extended area codes.

If the indicator circuit is arranged to work with originating markers equipped with 6 digit translation (sender recycle) and access code features, the "EA" and "LA" leads are used to distinguish between the two functions of the CC- leads. (Fig. 39 and WN option).

- (1) When a (CC-) key is operated for a compressed code, the (EA) key operated grounds the "EA" lead as an indication that the grounded CC- leads are used to indicate a code in one of the adjacent numbering plan areas. The assignment of the (CC-) keys to adjacent numbering plan areas is arbitrary and local information is necessary to determine which key unit to depress, with the exception of (CCO) which is always for the home national numbering plan area code. If keys (EA) and (CCO) are

operated, simulating the prefixing of the home national numbering plan area code to the called number by mistake, a local code three digit translation will result.

(2) When a (CC-) key is operated to indicate access code information the (EA) key is left normal which causes lead "LA" to be grounded to the marker. Lead "LA" grounded is an indication that the grounded leads "CCO" and "CC7" represent access code (prefix-digit) "zero", leads "CC1" and "CC7" represent access code (prefix-digit) "one" and leads "CC4" and "CC7" - no access code.

On a recycled call having a prefix-digit "one," in addition to the "EA" lead and two out of five "CC-" leads grounded to indicate the compressed code, the (PD1) key must be operated to ground lead "PD1" to the marker for indicating prefix-digit "one". Prefix-digit "zero" calls are not recycled.

The (SLC) key (MFR-DISC) is a lever type used to test the marker route used for originating sender local control. When operated it grounds leads A2 and A4. When this key is used the E1 type key of the "A" row, used for regular codes, must be normal.

(b) Class of Service Keys

The class of service keys consist of one row of ten push button keys designated (0) to (8) inclusive, and (NM); a lever type key designated (SG); and the (SGR) CLEJ key.

The (0) to (7) keys are operated to set up any class of service for simulating calls from one group of subscribers senders. To simulate calls from a second group of subscribers senders the (SG) key is operated with the (1) to (7) inclusive keys thereby providing duplicate classes of service for this group, by grounding, the D8 lead. The (8) key is operated alone to simulate a call from a key pulsing "A" switchboard sender; and the (NM) key is operated alone to simulate a call from a key pulsing "A" switchboard sender requiring no marker functions in the originating marker.

When the senders are arranged for max. 12 classes of service, in one sender group, the keys will be operated as explained above except that the 1 to 6 key will be operated with the (SG) key normal for the first 6 classes and with the (SG) key operated for the next 6 classes.

When the senders are arranged for more than 12 classes in two sender groups the (SGR) key will be furnished and the keys will be operated as follows: First 6 classes, 1 to 6 key operated (SG) and

(SGR) keys normal. Second 6 classes, 1 to 6 key operated, (SG) key operated (SGR) key normal. Third 6 classes, 1 to 6 key operated, (SG) key normal, (SGR) key operated to ground the "SGR" lead. Fourth 6 classes 1 to 6 operated (SG) key operated (SGR) key operated.

The markers may not be arranged to record all possible classes but they should be tested for all that they receive in service.

(c) District Frame Keys

The district frame keys are designated (F) and are numbered from 0 to 9 with an add-ten key designated (F10) to enable district frame selections to be made from 0 to 19.

7.202 Zone Charge Keys, Fig. 14 - M.R.

In addition to operating the transmitting keys, it is necessary to operate a zone charge checking key when the code calls for a zone charge. There are 10 of these keys designated (ZA) to (ZJ) and each one corresponds to a similarly designated relay in the originating marker, (max. 6 required). It is, therefore, necessary to operate the particular key which corresponds in designation to the relay that should operate in the originating marker for the particular zone charge required by the code being transmitted, otherwise the originating marker will block and fail to complete the call. These zone charge keys are for the purpose of simulating the closures that the originating marker would ordinarily receive from the zone registration control circuit, which circuit is not connected for a test call as is the case with a regular service call due to the (LC) relay in the district link and connector circuit not being operated.

If it is desired to test the operation of the originating marker for a condition where no zone device is available, the (ZOF) key is operated to duplicate this condition. When the marker has the ZS lead grounded for zone start signal, the (ZS) relay is operated. The (ZS) relay closes ground thru the (Z) relay to the (ZOF) key. With the (ZOF) key normal, the ZL lead for zone locking is grounded, and with the (ZOF) key operated the ZO lead for zone overflow is grounded.

7.203 Message Register Key, Fig. 14, MR.

For markers that do not check for false opens of the "MR" lead.

If it is desired to test the ability of the originating marker to give an

immediate trouble release in the case of failure to obtain a check on its "MR" lead to the district junctor circuit, the (MR) key is operated to open the ground that would ordinarily simulate a satisfactory check from the district junctor circuit.

For markers arranged to check for false open and false battery on "MR" lead.

The following is a list of tests that should be made on markers arranged to call in the trouble indicator in case of trouble on the "MR" lead.

KEY OPERATED-TEST

None - To test (MR) for operate
 Test OK
 (MR) Fails to Operate
 (MR) - To test for Short on Make Contacts of (MRK)
 Test OK
 Contacts Shorted
 (MR1) - To Test for False Bat. on "MR" Lead and for
 Short on Break Contacts of (MRK)
 Test OK
 Contacts Shorted
 (MR2) - To Test (MRK) for Operate and Release when
 (MR1) Operates
 Test OK
 (MRK) Fails to Operate
 (MRK) Fails to Release

MARKER TIMES OUT

LAMPS

No	MR
Yes	None
Yes	None
No	MR1
Yes	MR1
No	MR1
No	MR1
Yes	None
Yes	MR1

7.204 Automatic Message Acct. Check Fig. 34

Index master key operated.

When any index key combination is depressed the corresponding MIO, MI1, MI2, MI4 or MI7 relays should be operated from the marker. Two contacts of the depressed key, shunt the two normally closed contacts of the operated relays thus closing the sequence check that 3 relays are normal. Ground from the (F) relay operated (Fig. 1) thru a contact of an operated (MI-) relay, two shunt contacts of the depressed index and 3 normal MI- relays, operates the (MIN) "MI normal relay". Ground thru the other operated (MI-) relay, (MIN) operated and the operated index master key, grounds the ZK lead which holds the (MICK) relay in the marker and permits the marker to advance.

If the O index key is operated the marker (NC) no charge relay operates (NC1) and the (NC1) of this circuit, operates (MIN) if all index relays are normal and this grounds the ZK lead, locking the marker (NC1) relay. When AMA check is not being made the MIN lamp will light if the O index key is left in the operated position. This key should be restored to normal or the MIN lamp ignored when taking trouble readings.

7.205 Selecting and Seizure of the Originating Marker

The transmitting keys having been operated to set up the proper information in the originating marker for the test call, the next operation is to select the desired

originating marker circuit by operating a (DT) key. There is a (DT) key and relay in the trouble indicator, Fig. 2 or 30, for each associated originating marker, and the one associated with the originating marker to be tested is operated. The (ST) key is now operated to seize the originating marker and start the test call. The operation of the (ST) key operates the (ST) relay provided that the (DC) and (HD) relays are released indicating that the trouble indicator is normal. Upon operating, the (ST) relay operates the (DT) relay and locks by its secondary winding under control of the same relay, (a) connects ground to the "DB" lead of the originating marker to be tested to hold it busy, (b) connects ground to the winding of the (TM1) relay to start timing the seizure of the originating marker, (c) connects the winding of the (TM) relay to the "TM" lead of the decoder marker, (d) locks relay (DT) and opens the operating circuit of all other (DT) relays and (e) operates the (RM) relay which grounds the "TIB" leads of all markers except the one to be tested. The "TIB" lead of the marker to be tested is opened by the (DT) relay and later switched to the normal operating circuit of the (RM) relay, so that this originating marker will be able to summon the indicator when the test call is completed. The (TM1) and (TM2) relays are slow-acting to allow time for an originating marker to be made busy to the trouble indicator, if an originating connector is about to engage it at the time the (ST) key is operated, thus preventing the possibility of connecting to a busy circuit. The operation of the (TM1) relay operates the (TM2) which locks and releases the (TM1). The release of the (TM1) completes a circuit

for operating the (DC) relay. However, if the originating marker is busy or was engaged by a connector circuit during the time interval allowed by the slow acting (TM1) and (TM2) relays, the (TM) relay will have operated by ground over the "TM" lead. The (TM) relay operated; opens the operating circuit for the (DC) relay, thus preventing the trouble indicator from being connected until the marker is released. The start of a test call may, therefore, be delayed during the time required for the completion of one call by the originating marker circuit.

After the trouble indicator is connected, the originating marker is held busy to all originating marker connector circuits by the ground that was closed to the "DB" lead when the (DT) relay operated.

The operation of the (DC) relay, (a) disconnects the (TM) relay from the "TM" lead of the originating marker, (b) opens the alarm starting lead to prevent an alarm from being given while the circuit is engaged for testing, and (c) connects ground to the "CIF1" lead of the originating marker under test, operating the (CIF1) relay. This relay operates the (CIE), (CIG), (CIH), (CII), (CIF2) and (DMT) relays. These relays connect the testing leads and prepare the originating marker for receiving the test call. The (CIE), (CIG), (CII) and (CIH) relays connect the originating marker transmitting and receiving leads to the trouble indicator and grounds the "MC" lead, Fig. 1, as a signal to the trouble indicator that these leads are closed. Ground on the "MC" lead operates the (KY) relay in Fig. 15, which in turn operates the (KY1), (KY2), (KY3) and (TMT) relays, and connects ground to the "CKG" lead of the originating marker. The (KY), (KY1), (KY2) and (KY3) relays together close the transmitting keys to the originating marker receiving leads, operating the originating marker and trouble indicator receiving relays and starting the test call thru the originating marker circuit. The operation of the (TMT) relay connects ground to the "TM" lead of the originating marker, and starts the timing relays to measure the time required by the marker to complete the call.

7.206 Originating Marker Operation When Handling a Test Call

The originating marker upon receiving the code, class of service and district frame information on its receiving relays, checks to determine that all the necessary information for the call is complete and then proceeds to summon the district and office link and connector circuits and to select an idle outgoing trunk. When handling service calls it also connects to the district junctor circuit from which the call originated and selects an idle combination of district link, office junctor and office

link paths between the district junctor circuit and the selected outgoing trunk. However, a district junctor circuit is not used for a test call and the (LC) relay in the district link and connector circuit is not operated to close the "OT", "TRL", "TP", "TC", "AK", "SL" and "MR" leads to a district junctor, or the "LS" leads to the district link primary switch holds magnets, or the "ZS" lead to the zone registration control circuit. The zone start lead "ZS" not being closed, the zone charge leads "ZA" to "ZJ" and the zone lock and zone check leads "ZL" and "ZK" will not be closed to the zone registration control circuit, when the test call requires zone charging. Therefore, the test circuit simulates that part of a district junctor circuit and zone registration control circuit necessary to enable the originating marker to handle the call, and to test its ability to satisfactorily perform the functions with these circuits. The (F) relay in Fig. 1 replaces the (F) relay of a district junctor circuit, the (DPH) relay and the (C) resistance in Fig. 1 replace the district link primary switch hold magnet, the (LC) relay in Fig. 14 replaces the (LC) relay of the district link and connector circuit, and the (OT), (TC) and (TP2) relays replace the (OT), (TC) and (TP) relays in a district junctor circuit. The zone registration control circuit functions are replaced by the (ZA) to (ZJ) keys, and the (Z) and (ZS) relays in Fig. 14. The function of the sender (TDR) relay is replaced by battery thru the (TDV) resistance in Fig. 1.

When the marker connects to the district link and connector circuit and ground is connected to its "DK" lead, the (F) relay in Fig. 1 of the test circuit is operated in place of the (F) relay in a district junctor circuit. The (F) relay operates the (LC) relay in Fig. 14 and completes the ground over the marker "DC" lead to its "AK" lead operating the (AK) relay in the originating marker. With the (LC) relay in Fig. 14 operated, the marker is enabled to perform its charge and talking transmission functions with the relays in this figure corresponding to similar relays in a district junctor circuit, and zone registration control circuit when the code is for a call requiring zone charging. With AMA the (F) relay takes over the test of the OT lead, the only remaining function of Fig. 14.

After the originating marker has selected an idle outgoing trunk it proceeds to select an idle office link, office junctor and district link combination the same as when handling a service call except that all district link paths will test idle since the "LS" leads to the district link are open. Therefore, the idle combination of paths will be determined by the office links and office junctors. The first idle combination of these paths will satisfy the marker and it will proceed to close through the

connections between the selected outgoing trunk and the district link frame operating the office link primary and secondary switch holds magnets and the district secondary switch hold magnet, and closing the cross-points on the office link primary and secondary switch. However, the district secondary switch crosspoint will not be closed as the select magnet is not operated and, of course, neither the hold nor select magnets are operated on the district primary switch because of the (LC) relay in the district connector circuit not being operated.

In connection with the district link selection by the originating marker, the operated (F) relay in Fig. 1 completes a circuit between the "SL" and "LS" leads of the marker. This connects battery through the marker (SL) relay in parallel with battery through the (C) resistance in Fig. 1 to operate the marker (A) relay when the channel selection relay operates. The (C) resistance in Fig. 1 simulates the district link primary switch hold magnet. When the marker closes the operating circuits for its (S) relay this same circuit is closed over the "S" lead of the test circuit operating the (DPH) relay in Fig. 1. This relay disconnects the (C) resistance and replaces it by its own winding to simulate the district primary switch hold magnet. In making this substitution of its own winding in place of the (P) resistance it also arranges to place the marker (SL) relay and its own winding in parallel with the marker (S) relay and the hold magnets of the district secondary, office primary and office secondary switches thus simulating service conditions for the winding of the marker (B) relay, and also provides for operating the marker (SL) relay.

When both the (S) and (SL) relays in the marker operate, they remove the ground that has been shunting the marker (B) relay winding and it operates. The operation of the (B) relay releases the (AK) and (AK1) relays in the marker and they disconnect ground from the "AK" lead releasing the (F) relay in Fig. 1 of the test circuit. The (F) relay in releasing connects the "G" and "DLS" leads together thereby shunting the marker (B) relay winding and holding the hold magnets, together with the (S) and (SL) relays in the marker and the (DPH) relay in the test circuit, operated in parallel thus simulating the release of the (F) relay in a district junctor circuit. The (B) relay in the marker releases and completes a circuit for operating the (TR) relay in Fig. 1 of the test circuit instead of the (MRL) relay in the marker this circuit having been switched by the operation of the (DMT) relay when the marker was prepared for the test call. The operation of the (TR) relay in the test circuit operates the (TR) relay in the originating marker and this relay calls for a record to be taken the same as for trouble indicator operation.

If the originating marker should fail for any reason to complete its regular functions and operate the (TR) relay, then the timing relays will close this circuit at the expiration of the time interval.

7.207 Recording Originating Code Translation and Disconnect of Transmitting Keys

If the originating marker successfully translates the information set up on its receiving relays and advances to the stage where its sender release relay (SR) is operated, it grounds the "RL" lead. In the case of a regular service call, this will cause the sender to be disconnected by the originating marker connector circuit but with a test call it operates the (RL) relay in the trouble indicator circuit. The (RL) relay prepares a path for lighting the (RL) lamp, and operates the (RL1) relay after which both relays lock under control of the (KR) relay until the release key is operated. The (RL1) relay operates the (GD) relay and releases the (CO) relays in the originating marker provided that the (NMR) relay is not operated. The (GD) relay connects ground to the locking leads of Fig. 16 and 18 locking all the recording relays that are operated in these figures to hold a record of the code, class of service district frame, alternate route, index overflow, prefix-digit and tip party information that was transmitted to the originating marker for the test call and to hold a record of the code translation that was transmitted by the originating marker circuit. The (GD) relay also operates the (RD) relay which releases the (CIE) connecting relay in the originating marker. The release of the (CIE), (CIG), (CIH) and (CII) relays disconnects the originating marker transmitting and receiving leads and disconnects ground from the "MC" lead releasing the (KY) (KY1), (KY2) and (KY3) relays. The release of these relays removes ground from the "CKG" and "TM" leads of the originating marker, and disconnects the test call transmitting keys thus simulating the disconnection of a sender circuit by an originating marker. The (TMT) relay in the trouble indicator, will remain operated after (KY) relay releases by ground on the "TM" from the marker. The (TMT) relay will therefore remain locked until the originating marker has released and returned to normal. This relay is for the purpose of preventing the trouble indicator from dismissing the originating marker until it has returned to normal.

7.208 Recording, Disconnection of Trouble Indicator, and Release of Originating Marker

The operation of the (TR) relay in the originating marker by either the call being completed or by the expiration of the time interval connects battery to the

"TIS" lead of the trouble indicator operating the (DS) relay associated with that originating marker.

The operation of the (DS) relay closes the "CIA" lead operating the (CIA) relay in the originating marker. This relay operates the (CIB), (CIC), and (CID) relays the same as in trouble indicator operation. However, the (CO) relays in the originating marker are not operated, the ground having been removed from the "CO" lead by the operation of the (RL1) relay. The (CIE), (CIG), (CIH), (CII) relays are therefore not operated to close the transmitting and receiving leads since the record previously taken from these leads is being held by the trouble indicator and furthermore the receiving and transmitting relays in the originating marker are released at this time. The operation of the (CID) relay in the originating marker grounds the "DR" lead operating the (DR) relay which locks under control of the (RL) key, prepares a circuit for lighting the (DR) lamp, and operates the (RT) relay.

The (DL) relay associated with the originating marker will be operated and unlike a service call the (DL) lamp will be lighted to test this feature by ground through the operated contacts of the (DT) key. Likewise the (DL) relays of any other originating markers that summoned the trouble indicator while it is busy will operate and light their lamps to indicate the originating markers that failed without a record being taken.

The operation of the (RT) relay operates the (RT1) relay and it in turn operates the (HD) relay. The (HD) relay locks under control of the (DR) relay, operates the (GD1) relay to lock the recording relays not already locked by the (GD) relay which was operated earlier, and releases the (RT) relay. The release of the (RT) relay releases the (RT1) which removes ground from the "CIA" lead releasing the (CIA) relay in the originating marker, and with the (DC) relay operated, connects ground to the "TIB" lead of the originating marker under test thereby signaling it to return to normal. The "TIB" leads of all other originating markers are already grounded by the (RM) relay which was operated before the test call was started.

When the originating marker has released it removes ground from its "TM" lead releasing the (TMT) relay in the trouble indicator. The release of this relay, with the (RL1) or the (HD) relay operated, operates the (EC) relay. The (EC) relay lights the (EC) lamp on test calls only and releases the (DT) relay. The release of the (DT) relay removes ground from the "DB" and "CIF1" leads of the originating marker, and releases the (ST) relay in the trouble indicator. The disconnection of ground from the "DB" and "CIF1" leads release the test

preparation relays in the originating marker and removes the busy condition provided that a plug is not inserted in its make busy jack. The (EC) relay operation is controlled at the (HD) relay in order to avoid failure to release the marker if the marker encounters a trouble on a call after having failed to find a trunk.

7.209 Recording, Disconnection of Trouble Indicator and Release of Originating Marker on Bridged Markers Test

Since the originating marker (SR) and (TR) relays are operated at approximately the same time, the (RL) and (RL1) relays may not be operated. Under these conditions the preferred (DS-) relay closes ground from (HD) and (KR) normal to operate the originating marker (CIA) relay. The (CIA) operates the (CIB), (CIC) and (CID) relays. The (CO-) relays in the originating marker are operated because (RL1) remained normal. The (CIE), (CIG), (CIH) and (CII) relays operate to close the transmitting and receiving leads. The operated (CID) relay grounds the "DR" lead operating the (DR) relay which locks under control of the (RL) key, prepares a circuit for operating the (DR) lamp, and operates the (RT) relay.

Operation of the (RT) operates the (RT1) and in turn the (HD) and (RT2) in Fig. 38 to ground at the plugged (BM) jack "WC" option. (RT2) operated closes ground over the remaining "CIA" leads to operate the originating marker (CIA) relays whose operate paths were previously partly closed by the respective operated (DT-) relays, locks to the (RT1) relay "WC" option, and opens its own operate circuit "WC" option toward the (BM) lamp and jacks. The (HD) relay locks under control of (DR), operates the (GD) and (GD1) relays, and releases the (RT) relay. The releasing (RT) releases the (RT1) and in turn the (RT2) which removes all grounds through the individual contacts from the associated "CIA" leads, thus releasing all the "CIA" relays in the corresponding markers involved in the test. Operating and releasing of the (CIA) relays in this manner is necessary to relieve excessive contact loading which would otherwise arise on the single contact of the (RT1) relay, WB option.

7.210 Display of Recorded Information

After the trouble indicator has disconnected from the originating marker the (DR), (DL), (RL) and (RL1) relays are locked operated to ground thru back contacts of the (KR) relay and therefore cannot be released until the (RL) key is operated, operating the (KR) relay. The (DR) relay holds the (HD) relay operated, and it holds the (DC), (GD) and (GD1) relays and provides ground for operating the (LP) relay when the (LP) key is operated. The (DC) relay is also locked under control of the (RL1) relay.

The (GD) and (GD1) relays hold all recording relays and the (RD) relay. The (RD) and (DC) relays hold the (RM) and (RM1) relays operated to make the trouble indicator busy while it is holding a record. The information recorded can now be displayed by operating the (LP) key.

The operation of the (LP) key operates the (LP) relay which connects battery to all of the display lamps, and those which are grounded by their associated recording relay being operated, will light thus displaying the information taken from the originating marker. The lamps will remain lighted until the (LP) key, which is of the locking type, is released or the (RL) key is operated releasing the recording relays.

7.211 Release of Trouble Indicator and Start of Another Test Call

To release the trouble indicator, the (RL) key is operated, operating the (KR) relay. This relay locks by its secondary winding to the operated (DC) relay and opens the locking circuits of the (DR), (DL), (RL) and (RL1) relays and they release. The release of the (DR) relay releases the (HD) relay and it releases the (GD) and (GD1) relays, and the (LP) relay if operated.

The (GD) and (GD1) relays release all recording relays except those that lock under control of the (KR) and (RL1) relays. (See Paragraph 6.32).

The (RL) and (HD) relays release the (DC) relay and it releases the (RM), (RM1) and (KR) relays restoring the circuit to normal.

The (TM2) relay which was operated at the start of the test, is released when the (TMT) relay operates so that it will have time to completely de-energize before another call is started.

After the (RL) key is operated another test call can be started to the same originating marker by operating the (ST) key. If it is desired to test another marker, the operated (DT) key is released and the one associated with the other marker is operated before operating the (ST) key. The code, class of service and district frame transmitting keys will remain operated unless reset for a different call.

7.3 Key Pulsing Sender Calls Requiring No Marker Functions But Only Decoder Functions

To originate a call, simulating a call for direct trunk connection from a key pulsing sender requiring no marker functions in the originating marker, the code and district frame keys are set and the (NM) class of service key is operated. This key in addition to setting the receiving relays in

the originating marker for a key pulsing sender call prepares the trouble indicator for taking a complete record when the originating marker transmits a sender release signal.

The operation of the (NM) key in Fig. 15 operates the (NMR) relay in Fig. 1 and prepares a path for lighting the (NM) lamp when the (RL1) relay operates. The operation of the (NMR) relay changes the functions of the (RL1) relay. First, it prevents it from operating the (GD) relay; second, it prevents it from releasing the (CO) relays in the marker, and third, it prepares a path for it to operate the (RT2) relay. When the originating marker grounds its "RL" lead operating the (RL) and (RL1) relays, the (RT2) relay grounds the "CIA" lead operating the (CIA) connecting relay in the originating marker which in turn operates the (CIB), (CIC) and (CID) relays, the (CIE), (CIG), (CIH) and (CII) relays are already operated.

With all the connecting relays operated a complete record is taken at which time the (CID) relay grounds the "DR" lead operating the (DR) relay in Fig. 2 of the trouble indicator. The operation of the trouble indicator circuit is then the same as already described for regular operation. The (NM) lamp will light when the (RL1) relay operates, and the (DC) lamp will be lighted when the (TMT) relay releases thus indicating the completion of a no-marker call.

In connection with originating a no-marker call the zero district frame key should always be operated otherwise a false district frame indication will be given due to the false operation of the zero district frame recording relay when the originating marker receiving relays release.

7.4 Recording an All-Trunks-Busy Condition

The originating marker selects an idle outgoing trunk before giving a sender release signal. If it is unable to find an idle trunk while handling a test call, the (TB5) relay in both the originating marker and the trouble indicator will be operated. The operation of the (TB5) relay in Fig. 25 operates the (NMR) and (RL1) relays. Thereafter, a complete record is taken of the information set up in the originating marker, after which the connecting relays are released and the marker returns to normal.

7.5 Reorder Release Signal

If a denied code is set up on the transmitting keys for a key pulsing sender call, the originating marker will ground its "RO" lead, operating the (RO) relay in Fig. 25. The operation of the (RO) relay prepares a path for lighting the (RO) lamp, and operates the (RL1) and (NMR) relays.

Thereafter the operation is the same as the recording of a no-marker call, or an all-trunks-busy condition.

7.6 Recording When the Originating Marker Encounters a Message Register Check Failure, an All-Channels-Busy, or Trunk-Stolen-by-Panel Condition

If the originating marker encounters any of these conditions in attempting to complete a call it will ordinarily close a circuit to operate its (RL) relay and connect ground to its "TRL" lead if it is a first or second trial call, and then restore to normal. If it is a third trial call, it will simply restore to normal. On a test call, the operation of the (DMT) relay in the originating marker switches the (RL) relay operating circuit to the (TR) relay in the trouble indicator circuit. The operation of this relay summons the trouble indicator to take a complete record as already described for a completed call. In addition the (MRL) the (CRL) or (DT3) relay will be operated and prepare a path for lighting its associated lamp to indicate what caused the circuit to fail in completing the call. In addition the (TRL) lamp will be lighted indicating that the marker gave a trouble release on the first or second trial call. The (MRL) lamp indicates that the marker failed to receive a check on its message register lead. The (CRL) lamp indicates that the marker encountered on all-channels-busy condition. The (DT3) lamp indicates that the trunk selected by the marker was stolen by a panel selector.

7.7 Test for False Ground on "DK" and "DK1" Leads in the Marker

While the test of the marker is in progress the primary winding of relay (XDK) is connected to leads "DKT" and "DK1" to the marker. Lead "DKT" connects to lead "DK" in the marker and lead "DK1" connects to a contact of relay (DK) in the marker, which operates when the "DK1" lead from the district frame to the marker is grounded. False ground on either of these leads will operate the (XDK) relay, which locks and prevents operation of relay (DSB) blocking the test. If these leads are free of false ground, the battery supply from the office frame, which is normally used for operating the marker preference relay on the district frame, is used on test calls to operate relay (DSB). This relay locks, disconnects the (XDK) relay from the marker leads, and extends the battery supply from the office frame to the district frame, operating the (MP) relay to let the test call proceed.

7.8 Test for the Toll Diversion Feature in the Originating Marker

A code requiring the toll diversion feature is set up on the originating trouble indicator keyset. While the set of the

marker is in progress battery thru resistance (TDV) is placed on the "TDV" lead to the marker. With relay (TDV) in the marker operated by the route translation, the "TDV" lead battery is closed to operate the (TDVK) relay in the marker. The (TDVK) relay in the marker operated grounds the "TDVK" lead to operate the (TDVK) relay in the originating trouble indicator which lights the (TDVK) lamp. Failure of battery closure to the "TDV" lead or a false ground on the "TDV" lead will result in failure of the (TDVK) relay in the marker to operate. If the TDVK lamp is not lit due to a false ground on the "TDV" lead relay (XTD) would have been lit instead. This failure of the (TDVK) relay will block the marker forcing a trouble indication at the originating trouble indicator. The trouble indicator lamp display shows a toll diversion feature failure since the TCVK lamp is not lit.

7.9 Test for the Automatic Number Identification Feature in the Originating Marker

7.91 A code requiring the automatic number identification feature is set up on the originating trouble indicator keyset. During the marker operation a check is made that the proper route auxiliary relay (RA-) and associated check relays (SKP, TDG) are operated in the marker. Failure to operate the check relay results in an open "TK" lead in the marker, causing the marker to block and time out. The marker seizes the originating trouble indicator for a trouble display.

The trouble indicator display shows an ANI feature failure since the (TK1) lamp is not lit. If a proper check is made, the "TK" lead is closed through and the (TK1) lamp is lit at the trouble indicator display panel.

7.92 If an ANI call was originated by a subscriber on a two-party line, checks are made that the proper party information is primed in the ANI trunk and in the originating marker. Failure of any of these checks result in an open "S1" lead in the marker causing the marker to block and time out, forcing a trouble indicator, the trouble indicator display shows the failure since the (SlK) lamp is not lit. If a proper check is made the "S1" lead is closed through and the (SlK) lamp is lit at the trouble indicator display.

7.10 Immediate Release Feature

The test control circuit in the trouble indicator is arranged to immediately release the trouble indicator and the originating marker circuits at any time. If for any reason it is desired to wipeout the call after operating the start key (ST), the operation of the (RL) key will operate the (KR) relay and restore the trouble

indicator to normal, and also the originating marker if it has been seized.

The operation of the (KR) relay in addition to opening the locking circuits for all relays in the trouble indicator, opens the "MC" lead releasing the (KY) relays, and connects ground to the "MRL" lead of the originating marker circuit. If the originating marker is in its decoding stage the release of the (KY) relay will restore it to normal, or if it is in the marker stage the (MRL) relay will cause it to release. In either case ground will be removed from the "TM" lead and the (TMT) relay in the trouble indicator will release permitting the trouble indicator circuit to disconnect. A second call can be immediately started by operating the (ST) key. If the (ST) key is operated prematurely it will be ineffective until the trouble indicator has restored to normal.

7.11 Remote Control

Remote control jacks are provided for use in connection with a 32A test set in order that the operation of the equipment in the originating marker and its associated circuits can be readily observed during the handling of a test call. These jacks are located on the originating marker, district link, and office link frames. When a 32A test set is connected to one of these jacks the operation of the white button controls the start key circuit and the red button controls the release key circuit.

8. TROUBLE INDICATOR MAKE BUSY JACK

A make busy jack is provided in the trouble indicator for each associated originating marker circuit to make the trouble indicator busy to any one or all originating markers as desired. These jacks are mounted on the trouble indicator frame and are designated (TIB). A plug with the sleeve and ring connections strapped, inserted in one of these jacks connects ground to the "TIB" lead of the associated marker thereby marking the trouble indicator busy to that particular circuit.

9. VERIFICATION OF GROUP START AND GROUP END

With the (GSE) key, Fig. 35, in the "ON" position the (GSE) relay in the originating marker will operate. The (GSE) relay operated removes battery from all trunk testing (T-) relays so that all trunks in the group appear idle. It also provides an off-normal ground for operating the even numbered (K-) relay indicating the group start point and the odd numbered (K-) relay indicating the group end point. This should correspond with the cross-connection information for "Group Start" and "Group End".

With two (K-) relays operated at the same time a trouble release with an (XSS) lamp will be indicated. Since the purpose of the test is to verify the "Group Start" and "Group End" points only, lamps not directly concerned with the test should be disregarded.

It is not necessary to take the marker out of service to perform this test.

10. BRIDGED MARKERS TEST - COMPARISON OF ROUTE RELAY CROSS-CONNECTIONS

This test provides a comparison of cross-connections of route-relays for the same route in from two to four markers in the same marker group simultaneously. A check of all routes can then be accomplished by testing all markers in groups of four or less.

The test described in the following paragraphs is to be made with the following precautions observed.

1. The groups start and group end cross-connections for each route to be tested should be verified when:

- (a) An initial test is to be made.
- (b) Changes in group start and group end cross-connections have been made.

Failure to do this can result in an operated "T" fuse in one or more of the markers involved in the test, except when a code compression test is made where the maximum number of markers will be two.

2. A maximum of four markers in the same marker group are to be used in each comparison test.
3. The markers used in the test are to be synchronized in regard to office frame selection and trunk subgroup selection if trunk subgroups are involved for routes in the test. To maintain synchronism when it is required the markers used in the test should be made busy for the duration of the test.
4. The routes tested must be treated the same in all markers.
5. The test is to be performed during periods of light traffic.
6. This test cannot detect open cross-connections on any of the "O" relays since the operation of any of these relays does not ground any leads in normal operation.

The test is performed in the following manner.

With 329A solid metal plugs inserted into the (BM) jacks, Fig. 36, of the markers involved and all (DT) keys normal the (ST) key is operated. The markers with plugged (BM) jacks are seized simultaneously. The trouble indicator shows a trouble record and, in addition, a momentarily lighted (BM) lamp, Fig. 37, associated with this test and a lighted (DR) lamp for each marker seized.

The entire trouble record is not of interest in this test. We are interested in those lamps which have a direct bearing on the marker route relay cross-connections.

In a comparison test where the cross-connections for the same route are in agreement in each marker, the lamp display will include, in addition to various check and progress lamps, the indications associated with the OB-OG-SG-CR-CL-SP-TL and ST cross-connections obtained in a normal test of the code in one marker. The (XDC) lamp which lights for every test and the (XSL) lamp which lights occasionally are both disregarded in analyzing the lamp display.

In a comparison test where the cross-connections for the route are not in agreement in each marker the lamp display will include, in addition to various check and progress lamps, one or more of the following representative indications shown with their interpretation. This following table is a guide, the actual lamps, would depend on the options in use in the markers.

Error Indication	Improper
Lamp	Cross-Connection
XX1 All OB's & OG's - SO, SD, SD1	OB OG
XT All CR's, CL's & SG's, SSO, TW & 7DG, SK2, SK3	CR SG CL
All OB's, OG's - SO, SD, SD1, etc. or none	SP
Two or more TL's	TL
Two or more ST's	ST
Two or more transmission check relay lamps	R
On route advance or alt. route same as RC	RA
Can be all or some of the above error indications	RC

When an error indication appears in the test the marker or markers causing it can be found by repeating the test and removing one marker per test. When the marker at fault is removed, the error indication will disappear at the indicator

display on the next test. A marker is removed from the test by removing the plug from its (BM) jack.

11. TAKING EQUIPMENT OUT OF SERVICE

The originating trouble indicator can be taken out of service by making it busy to all associated originating markers. This is accomplished by the insertion of a 322A plug into the (TIB) jack of each of the associated markers. These jacks are located on the trouble indicator frame.

The originating trouble indicator should be kept out of service for as short a time as possible. It should be kept in mind that if the marker attempts to seize a busy trouble indicator a major alarm sounds.

12. ALARM INFORMATION

12.1 The originating trouble indicator has three separate functions. First, it can detect a false ground on certain leads in the originating marker although the marker is idle. Second, in the course of a call in which the marker is engaged and fails to perform its functions, by summoning the trouble indicator the display lamps will show progress up to the failure plus other pertinent facts about the call in trouble. An analysis of the lamp display will point out the source of trouble as nearly as possible. Third, the trouble indicator can be used to make manual test of the originating marker, and, in this case, the lamp display is used to check the operations of the marker.

The trouble indicator calls attention to its automatic operation by a minor intermittent or major alarm. When either alarm sounds and a lighted TI lamp is found at the trouble indicator frame, operation of the LP key will show a lamp display of the marker trouble.

With Fig. A provided, operation of the RL key retires the alarms and restores the trouble indicator to normal. Operation of the ACO key retires the minor intermittent alarm but does effect the alarm lamp indication.

With Fig. B provided, operation of the (RL) key retires the alarms and restores the trouble indicator to normal except when a ground cross exists on a locking lead for the register relays. Under this condition, lamp (XLG) will light and relay (XLG) will remain operated to hold the trouble indicator busy. Operation of the (LP) key lights the lamps which are associated with the register relays held operated by the ground cross. Such a cross may be located in the multiple between the trouble indicator side of the marker cut-in relays and the

trouble indicator or in the trouble indicator itself. Since such a trouble has been known to render an entire marker group inoperative if repeated connections to the trouble indicator are permitted, therefore, such a trouble must be located and cleared at once. When the ground cross is removed, relay (XLG) will release and the originating trouble indicator will again be available for either trouble indications or marker test connections.

12.2 Trouble Analysis - Lamp Display

12.201 A list of the trouble indicator lamps and an explanation of their significance is shown in Paragraph 6.5.

12.202 Whenever a cross detecting lamp is lighted it indicates a cross on the leads associated with the lamp as described in the list in Par. 12.201. The various link frames which are responsible for the trouble indication may also be obtained, from lighted lamps. If the cross is between two contacts on a link connector relay so that a lead going to one marker is permanently connected to a lead within one of the link connector circuits, the trouble indication may give misleading information pointing to a wrong relay. It may also occur very infrequently, since to bring in a trouble indication it may be necessary to have the marker in trouble serving a call thru a link connector not associated with the trouble and, at the same time, another marker must be serving a call thru the link connector in trouble. Under this condition both markers may attempt to seize the trouble indicator. However, only one would seize it and, regardless of which marker left a trouble indication, it would not indicate the connector relay in trouble. The indicator may show either the wrong marker or the wrong link connector, hence, from analysis, the wrong link connector relay. The second marker in attempting to seize the trouble indicator would light a DL - lamp. Repeated records showing two markers and one connector and the one cross indication would show one particular marker in each indication but possible several connectors. Hence, it may be necessary to inspect all connector relays associated with the marker reported on each trouble indication on all link connector frames for crosses to the lead indicated.

12.203 After the progress lamps have been referred to, the information regarding the actual sender, marker connector, marker, district junctor, district or office link frame, trunk level, outgoing trunk and channel selected, trunk or channel group, charge condition or particular cross detecting relay should be obtained from the other lamps on the indicator lamp panel.

12.204 The descriptions accompanying indications 1 to 44 in Tables 1 and 2

on the following pages given general information which points to probable causes for the trouble. However, no attempt is made to cover all possible causes for these troubles. To assist in determining the lamps shown in Tables 1 and 2, which would be lighted under the various conditions, their positions are marked by a + sign; and when a lighted lamp is involved in a particular indication its position is marked by a + signal underlined, thus, +. Also, when an unlighted lamp is involved in an indication its position is indicated by a - sign. To further assist in checking these indications code 322, service class 3, and district junctor frame 4 are used as shown in indications 15-18.

12.205 To expedite the location of the point at which the progress of the marker was blocked, the progress lamps may be divided into two distinct groups as follows: If lamp MS which has a red cap is lighted, it is an indication that a call has proceeded to the marker stage and that lamps peculiar to the decoder stage which may be lighted should ordinarily be disregarded. However, if lamp MS is not lighted all lamps peculiar to the marker stage should be disregarded. A further subdivision of both decoder and marker stage lamps may then be made to assist in locating the trouble.

12.206 When the red MS lamp is not lighted, indicating that the call is in the decoder stage, and if one or two of lamps SPE, SPO, NSE or NSO are lighted, it is an indication that the code has been translated and an attempt has been made to seize an office link frame. If none of these lamps are lighted, then it may be assumed that the code had probably not been completely translated and reference to Table 1 for assistance in reading the indication should be made. If, however, one or two of lamps SPE, SPO, NSE or NSO are lighted, the lamps covered by Table 1 may be disregarded and reference should then be made to Table 2 which covers the progress lamps pertaining to the remaining functions of the marker.

12.207 If lamp MS is lighted, then, of course, all lamps in the decoder stage should be disregarded, unless it is later found that information regarding the actual code dialed on in overlapping call is necessary. If lamp CHE is not lighted, then a channel has been seized and the cause for not completing the connection would probably be in connection with the operation and checking of the hold magnets and closure of their contacts. This partial subdivision is only for the purpose of assisting the maintenance man to analyze the situation and more readily recognize and trouble causing the blocked conditions.

12.208 Referring to Table 1 which shows typical conditions up to actual operation

of some particular marker relay which may block a call, a brief explanation of several of the marker functions and the way they are recorded by the indicator lamps may be of assistance.

12.209 The first three trouble indications shown on Table 1 are open receiving leads A4, AR and OF. Table 1 shows that these troubles are similar, in that lamps B2, C2 and K5 are lighted. However, as the receiving leads A1 to TP are divided into three groups and associated with three check leads, leads A1 to A5, AR, OF and TP being associated with lead CK1, leads B1 to C5 with leads CK2 and leads D1 to F10 with lead CK3; and since all of leads associated with check leads CK1 and CK3 must be closed to cause lamp K4 to light; and since lamps A4, AR and OF are not lighted under their respective indications, the inference is that these particular leads may be open somewhere in the sender, marker connector or marker.

12.210 Somewhat similar troubles are shown by indications 4 and 5 except that the open conditions are associated with leads D4 and F4.

12.211 A third set of trouble conditions, as shown by indications 6 and 7 involving leads B4 and C4, are different in that lamp K4 is lighted instead of K5, pointing at once to some lead associated with check lead CK2.

12.212 Indications 15 to 18 shown on Table 1, while differing in that they refer to the tip and ring parties and that the call is a first, second or third trial by the sender are complete, and if none of the lamps SPE to NSO in Table 2 are lighted then the inference is that the trouble lies somewhere between the actual closure to operate the marker route relay or the closure of leads SPE to NSO by the office link frame.

12.213 Under the above conditions, the indications are such that the most logical lamps to check next would be the charge condition lamps PS1, NC1, OT1, TC1, ZA1 to ZJ1. If one of these lamps was lighted, it could then be assumed that the route relay was operated and the office link frame lamp OF- 0-9 should then be checked to determine whether the office link frame had been seized. Ordinarily it would not be expected that one of the office link frame lamps would be lighted since one lamp refers to a pair of office

link frames and it is not likely that one or both frames could be seized without having one of leads SPE to NSO closed.

12.214 Assuming that but one of lamps SPE to NSO is lighted, then it would follow that one lead was not closed by the office link frame MCA or the trunk level TL or TR relays. In any case, if the call is a first trial, the marker will block when but one of leads SPE, SPO or NSE, NSO is closed, complete its timing and seize the trouble indicator to record where the call was blocked. However, if only one of leads SPE to NSO is closed on a second or third trial by the marker, then the marker will automatically make the offending office link busy and proceed with the call on one office link frame; otherwise, all calls to the point reached by the trunks associated with this pair of office link frames would be blocked.

12.215 If two of lamps SPE to NSO are lighted the inference then is that all conditions up to actual seizure of a pair of office link frames are satisfactory. Further reference to the progress lamps shown in Table 1 will not be necessary unless information regarding the code dialed is required to determine whether the office link frames seized are proper for the code. The lamps shown on Table 1, while not generally referred to when the call has proceeded beyond the point where the office link frames are seized may be lighted when a record is taken any time up to actual release of the marker connector by the sender. Ordinarily when the marker is in the marker stage the indication does not show the lamps per Table 1; but if a second call overlaps the first call and is in the decoder stage of this particular marker when a record is taken of the marker stage, it will indicate the progress of the overlapping call.

12.216 Tables 1 and 2 shows other indication of trouble, some of which are similar to the troubles referred to, but each indication must be analyzed separately to determine the probable cause of failure.

12.217 The progress lamps as shown in Tables 1 and 2 are arranged to as to follow the normal sequence of operative functions of the various features involved when setting up a call. While it is possible for two troubles to occur simultaneously, this condition is unlikely, therefore, only one trouble is considered when analyzing the record taken by the indicator.

TABLE I

Progress Indication Lamps
Receiving Leads

Indica- tion No.	Code					Service					Dist. Fr.					Misc. Leads			Check Leads		
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	AR	OF	TP	CKG	K4	K5
1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
7	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
11	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
12	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
13	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
14	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
15	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
16	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
17	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
18	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Example -
code - 322
Service Class - 3
dist. junct. fr. - 4

- + Indicates Lighted Lamp.
+ Indicates Lighted Lamp Associated with Trouble.
- Indicates Nonlighted Lamp Associated with Trouble.

Probable Cause of Trouble

- Open A4 Lead.
- Open AR Lead.
- Open OF Lead.
- Open D4 Lead.
- Open F4 Lead.
- Open B4 Lead.
- Open C4 Lead.
- Gr'd on CK1 or crossed A1-A5, AR, OF, TP.
- Gr'd on CK2 or crossed B1-C5.
- Gr'd on CK3 or crossed DI-F10.
- CKG Lead Open.
- CK1 Lead Open.
- CK3 Lead Open.
- CK2 Lead Open.
- Rec. Leads Checked. Ring Party. 1st Trial
- " " " Tip " 2nd "
- " " " " " 3rd "

TABLE 2

Indica- tion No.	SPE	SPO	NSE	NSO	DK	AK	TKE	TK	SR	RL	MS	CK	BK	CHE	A	C	S	SL	B	MR	S1K	MRL	TK1
19	+	-						+	+					+									+
20		+						+	+					+									+
21			+	-				+	+					+									+
22				+				+	+					+									+

Probable Cause of Trouble

- Even office link frame seized but odd office link frame not completely checked. Due to SP lead not being closed to or through trunk level relays. Outgoing trunks on split basis.
- Odd office link frame seized but even office link frame not completely checked. Due to similar trouble per indication 19. Outgoing trunks on split basis.
- Even office link frame seized but odd office link frame not completely checked. Similar trouble to indication 19. Outgoing trunk on nonsplit basis using NS lead.
- Odd office link frame seized but even office link frame not completely checked. Similar trouble to indication 19. Outgoing trunk on nonsplit basis using NS lead.

TABLE 2 (Continued)

Indica- tion No.	SPE	SPO	NSE	NSO	DK	AK	TKE	TK	SR	RL	MS	CK	BK	CHE	A	C	S	SL	B	MR	SLK	MRL	TK1
23	+	+			-		+	+						+									+
24	+	+			+	+	+	+						+									+
25	+	+			+	+	+	+						+									+
26	+	+			+	+	+	+						+									+
27	+	+			+	+	+	+						+									+
28	+	+			+	+	+	+						+									+
29	+	+			+	+	+	+				+	-	+									+
30	+	+			+	+	+	+				+	+	+									+
31	+	+			+	+	+	+				+	+	+									+
32	+	+			+	+	+	+				+	+	+									+
33	+	+			+	+	+	+				+	+	+			+	+					+
34	+	+			+	+	+	+				+	+	+			+	+					+
35	+	+			+	+	+	+				+	+	+			+	+					+
36	+	+			+	+	+	+				+	+	+			+	+		+			+
37	+	+			+	+	+	+				+	+	+			+	+		+			+
38	+	+			+	+	+	+				+	+	+			+	+		+			+
39	+	+			+	+	+	+				+	+	+			+	+		+			+

Probable Cause of Trouble

23. Office link frames seized but district link frame not seized. Due to failure to close start lead by the office link frame or by the marker relay DFO-DF19, or failure of district link frame to close check lead DK.
24. Office and district link frames seized but DC lead may not be closed between marker, marker connector, sender, district junctor, district link frame and again to the marker on lead AK.
25. Outgoing trunk not seized.
26. Outgoing trunk seized but transmitting relay check lead not closed.
27. Outgoing trunk selected, transmission check lead closed but marker SR relay not operated due to failure of office link frame to close the OK check lead.
28. Outgoing trunk seized and SR relay of marker operated to signal the sender to release the marker but failure of MS indicates that marker connector has not released. Cross condition on some lead may have caused relay XX1 to operate. RL lights only on test calls.
29. Release signal given to sender which has released marker connector releasing the decoder portion of marker to permit of overlapping call, but office link frame check lead CK not closed due to failure of office link frame LC relay or contact on office link frame MC relay. First call is now ready to start marker stage.
30. Check lead BK not closed due to failure of district link frame JC relay operating circuit or contact.
31. Channel not seized, due to failure of closure of chain contacts on ABL 0-9, CL 0-9, ABR 0-9 and CR 0-9 relays in marker.
32. Channel seized but due to cross condition and subsequent operation of relay XX2 in marker, district link or office link hold magnet circuits not closed.
33. District link hold magnet operating circuit open, or double connection on district link primary hold magnet, office link hold magnet operating circuit closed.
34. District link hold magnet circuit closed; office link hold magnet circuit open, or double connection on office link secondary hold magnet.
35. Office junctor hold magnet operating circuit not closed, due to failure of AC and AC1 relays to release.
36. Office junctor hold magnet operating circuit closed, closing office link primary and secondary hold magnets, but not fully closing district secondary hold magnet operating circuit.
37. Office junctor hold magnet circuit closing district primary and secondary hold magnets, but not fully closing office primary hold magnet operating circuit.
38. Office junctor hold magnet operating circuit closed, office primary and secondary hold magnets operated closing S relay circuit, district secondary hold magnet operated but SL relay in marker not operated due to open through district primary, district junctor F relay, district link frame LC relay, district link frame connector MCA relay, TPK, TP1, RP1, NC1, TCK or ZCK relay in marker.
39. Office junctor hold magnet, operating circuit closed, district primary and secondary hold magnets operated closing SL relay circuit, office primary hold magnet operated, but S relay not operated due to open through office secondary hold magnet, office link frame TL, MCA, or MCB relay, marker K - relays, AC1 or C relay.

TABLE 2 (Continued)

Indica- tion No.	Progress Indicating Lamp																	
	SPE	SPO	NSE	NSO	DK	AK	TKE	TK	SR	RL	MS	CK	BK	CHE	A	C	S	SL
40	+	+			+	+	-	+	+		+	+	+	-	-	-	+	+
41	+	+			+	+	-	+	+		+	+	+	-	-	-	+	+
42	+	+			+	-	-	+	+		+	+	+	-	-	-	+	+
43	+	+			+	-	-	+	+		+	+	+	-	-	-	+	+
44	-	-			-	-	-	-	-		-	-	-	-	-	-	-	+

Probable Cause of Trouble

40. District and office link hold magnets operated but ground cross condition, prevents operation of B relay due to crossed leads, a double connection from falsely operated select magnets or falsely operated junctor connector JC relays causing interference between markers setting up calls on different frames.
41. Hold magnet holding circuit found clear but false ground on AK lead prevents release of sender DC relay, district link frame LC relay or district Junctor F relay. Time out after trouble indication releases office and district link frames then causes the sender to time out.
42. District junctor F relay released, but failed to close ground to hold magnet holding circuit thus failing to release relay P for operation of the marker MRL relay.
43. Office link secondary hold magnet failed to close ground to outgoing trunk busy lead SL.
44. One of the DF 0-19, TL 0-14, TR, AR2, MR, XBE, XBO, JD, RL, OF1 or group start or group end relays which are operated on this call failed to release after the operation of MRL relay attempted to release the marker.

	TDVK	DK	AK	TKE	TK	SR	RL	MS	CK	BK	CHE	A	C	S	SL	B	MR	SLK	MRL	TKI	ANI	PTK	AN	IT	TRL
45	+	+	-	-	+	+	+	+	+	-	-	-	-	+	+	+	+	-	+	-	+	+	-	-	-
46	+	+	-	-	+	+	+	+	+	-	-	-	-	+	+	+	+	-	+	-	+	+	-	-	-
47	+	+	-	-	+	+	+	+	+	+	-	-	-	+	+	+	+	-	+	+	+	+	-	-	-
48	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
49	+	+	+	+	+	+	+	+	+	-	-	-	-	+	-	-	+	-	+	+	+	+	+	+	+

45. Transmitting relay check lead not closed on DDD/ANI class of call.
46. Marker checked for crosses and doubles on the district and office hold magnets, but failed when RPl lead is not closed by ANI tip party check feature in the marker.
47. Marker failed to operate ANI tip party check relay due to failure in ANI trunk to register tip party indication sent by the marker.
48. Toll diversion relay TDV in marker not operated when test is made of code requiring transmission of toll diversion signal to the sender.
49. Announcement relay operated in marker because announcement key operated and IT lead became grounded due to load register setting.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2319-CAB-LF-AI

OTI

XB-W500-1

RELAY DESIGNATIONS - FUNCTIONAL MEANING - ORIENTATION

ORIGINATING TROUBLE INDICATOR - SD-25018-01

A	G/35	- "A" (Link of Channel)
AO to 5	C/20	- "A" Digit (Register)
AK	E/33	- "A" Link Check (Closed for Busy test)
AR	H/21	- Alternate Route
B	G/33	- "B" Link of Channel
BO to 5	D/20	- "B" Digit (Register)
BK	G/36	- "B" Link Check (Closed for busy test)
C	G/35	- "C" Link of Channel
CO to 5	E/20	- "C" Digit (Register)
CF	A/4	- Marker Connector Frame
CH	A/6	- Channels (Selected)
CHE	G/36	- Channel end
CK	G/37	- C Link Check (Closed for Busy Test)
CKG	E/38	- Checking
CL-1 to 5	H/41	- Class of call
CN	C/58	- Marker Connector
CR-1 to 5	H/44	- Compensating Resistance
CR-6 & 7	G/43	- Compensating Resistance
CRL	E/57	- Channel Release
DC	C/13	- Decoder Busy
DF	A/10	- District Frame
DK	E/34	- Delay Cross Test
DL	E/51-E/8	- Trouble Indicator Busy
DO to 8	F/20	- Class of Service
DPH	G/16	- Decoder Marker Test
DR	E /52-F/9	- Number of Marker
DS	F51-G8	- Decoder Selector
DSB	C51	- Decoder Start Battery
DT	E/53-E10	- Double Test (S&S1 Leads)
DT3	E/58	- Double Test (S&S1 Leads)
EA	H/20	- Extended Area (Code Connector)
EC	G/15	- Extended Area (Fifties Relays)
F	G/16	- Frame (District Link)
FO to 10	G/20	- Frame (District Link)
G	C/56	- Trunk Sub. Group
GD	A/12	- Grounding Relays
GD-1	D/11	- Grounding Relays
GS-1 to 4	C/7	- Ground Supply
GT-3	G/58	- Group Transfer
GT-1	G/57	- Group Transfer
HD	A/13	- Holding Decoder
JC	C/54	- Junctor Connector

LAMP

ANI = TIP PARTY ANI CALL IN PROGRESS

PTK = TIP PARTY ANI CALL (TOK)

K4-5	E/37	- Key Pulsing
K	I/52-B/4	- Trunk Actually Selected
KR	F/15	- Key Release
KY	C/29	- Connect Transmitting Leads to Marker-Test Call
KY-1	C/27	- Connect Transmitting Leads to Marker-Test Call
KY-2	C/26	- Connect Transmitting Leads to Marker-Test Call
KY-3	B/28	- Connect Transmitting Leads to Marker-Test Call
LA	H/19	- Local Area (Code Connector)
LC	E/5	- Link Connector
LP	B/11	- Lamps
LP-1	A/11	- Lamps
M	C/53	- District Link Pri.-Sw. Level
MR	G/32	- Message Register
MR-1	E/58	- Message Register Failures
MRL	G/31	- Marker Release
MS	G/38	- Marker Stage
NC-1	C/45	- Non-Charge
N M	D/29	- No Marker Functions - Key Pulsing
NMR	G/12	- No Marker Functions - Key Pulsing
NSE	E/35	- Non-Split Even
NSO	E/34	- Non-Split Odd
OB-1	E/45	- Office Brush
OB-2	E/45	- Office Brush
OB-4	E/44	- Office Brush
OB-5	G/40	- Office Brush
OF	A/8-H/21	- Overflow OFFICE FRAME / over flow
OG-1 to 5	E/41	- Office Group
OT	F/4	- Opr. Talk
OT-1	C/44	- Operator Transmission
P	C/57	- Pattern Relay
PS-1	C/45	- Permanent Signal
RD	C/15	-
RL	E/55	- Release Timing
RL-1	G/13	- Release Timing
RM	I/11	- Ground "TLB" Leads
RM-1	1/13	- Ground "TLB" Leads
RP-1	C/42	- Ring Party
RO	E/56	- Reorder
RT	B/15	- Timing Recording Relays
RT-1	B/15	- Timing Recording Relays

S	G/34	- Sleeve (Of OGT Grded)
SB-1	G/41	- Second Office Brush
SB-2	G/44	- Second Office Brush
SB-4	G/44	- Second Office Brush
SD	E/43	- Station Delay
SD-1	E/43	- Station Delay
SDT	A/38	- Sender Test
SGR	F/18	- Second Office Group
SG-1	G/42	- Second Office Group
SG-2	G/42	- Second Office Group
SG-4	G/42	- Second Office Group
SG-5	G/45	- Second Office Group
SIK	G/33	- Sleeve Check (S-1 Lead)
SL	G/34	- Sleeve (District Junctor)
SM	B/9	- Select Magnet
SN	A/3	- Sender
SO	E/40	-
SPE	E/36	- Split Even
SPO	E/35	- Split Odd
SR	E/31	- Sender Release
ST	E/13	- Start
SW	C/9&C/53	- Dist. Link Pri. Sw. & Dist. Link Sec. Sw. Level
TC	F/3	- Talking Charge
TB-5	E/57	- Trunks Busy
TC-1	C/44	- Talking Charge
TCK	C/42	- Talking Charge Check (Ground Returned)
TK	E/32	- Transmitting Check
TKE	E/33	- Trunk End (Trunk Selected)
TL-0 to 14	A/7	- Trunk Level
TM	C/15	- Time Measure
TM-1	C/15	- Time Measure
TM-2	C/15	- Time Measure
TMT	G/12	- Time Measure
TM-6	C/49	- Marker Time - Out
TP	H/20	- Tip Party
TP-1	C/43	- Tip Party
TP-2	F/3	- Tip Party
TPK	C/41	- Tip Party Check
TR	D/16	- Trouble Release
TRL	E/15	- Trouble Release
TRL-1	E/15	- Trouble Release
TW	H/39	- Two Wire "Office"

XOB	A/37	- Cross Office Brush Relays
XOG	A/37	- Cross Office Group Relays
XSB	A/36	- Cross Second Office Brush Relays
XSG	A/36	- Cross Second Office Group Relays
XCR	A/35	- Cross Compensating Resistance Relays
XCL	A/35	- Cross Class Relays
XDK	C/51	- False Grd. on DK Lead
XTL	A/34	- Cross Trunk Level Relays
XXL	A/34	- Cross in Decoder Stage
XZ	A/33	- Falsely Grounded Zone Charge Lead
XZS	A/33	- False Ground on Zone Start or Zone Overflow Lead
XC	A/32	- More than one Charge Relay Operated
XT	A/32	- Falsely Grounded Transmitting Leads
XTC	A/31	- Falsely Grounded Charge Leads
XS	C/38	- False Ground on "S" Lead
XS1	C/37	- False Ground on "S-1" Lead
XGS	C/37	- False Ground on "GS" Lead
XGE	C/36	- False Ground on "GE" Lead
XGH	C/36	- False Ground on "S" or "LS" to District Link
XSM	C/35	- False Ground "SML" or "SMR" Lead to Office Link
XTL1	C/35	- Falsely Grounded "TL" Lead to Office Link
XLCE	C/34	- Falsely Grounded "LC" Lead to Even Office Link
XSL	C/34	- Falsely Grounded "SL" Lead to Dist. Link
XOF	C/33	- Falsely Grounded "OK" Lead to Office Link
XSS	C/33	- Two or More "SS" Relays Opr. in Office Link
XK	C/32	- False Ground on "NS", "SP" or "CK" to Office or "DK" Lead to Dist. Link
XRL	C/32	- False Ground on "RL" or "TRL" Leads to Original Marker
XDF1	C/31	- Cross Contact on Marker DF Relay
XLCO	C/31	- Falsely Grounded "LC" Lead to Odd Office Link
XDC	D/31	- Crossed or Grounded D.C. Lead
XSM1	G/74	- Two Pri: Sel: Magnet Energized or Dist. Link
Z	F/4	- Zoning
ZA1	A/45	- Zone Auxiliary
ZB1	A/45	- Zone Auxiliary
ZCK	C/42	- Zone Check
ZC1	A/44	- Zone Auxiliary
ZD1	A/44	- Zone Auxiliary
ZE1	A/43	- Zone Auxiliary
ZF1	A/43	- Zone Auxiliary
ZG1	A/42	- Zone Auxiliary
ZH1	A/42	- Zone Auxiliary
ZI1	A/41	- Zone Auxiliary
ZJ1	A/40	- Zone Auxiliary
ZK	C/41	- Zone Lock
ZL	C/40	- Zone Overflow (Zone Timers Busy)
ZO	C/40	- Zone Registration
ZR	G/55	- Zone Start
ZS	F/5	

RELAY DESIGNATIONS - FUNCTIONAL MEANINGS - ORIENTATION

ORIGINATING MARKER SD-25016-01

A	D/22	- "A" (Link of Channel)
A-1,2,4,5	A/54-57	- "A" Digit (Register)
AB (LO-R9)	I/27	- "A" and "B" Linkage (Channel Busy Test)
AC)	B/26	- "A" and "C" Links (Channel Closure OK)
AC-1)	C/23	
AK)	B/22	- "A" Link Check (Closed for Busy Test)
AK-1)	B/24	
AR	I/55	- Alternate Route
AR-1	I/9	- Alternate Route
AR-2	F/25	- Alternate Route
B	D/23	- "B" (Link of Channel)
B-1,2,4,5,5'	C/54-57	- "B" Digit (Register)
BE)	F/7	
BE-1)	F/18	- Busy Even (Office Frame - Trunks)
BF	B/94&H/8	- Busy Frame
BK	E/94	- "B" Link Check (Closed for Busy Test)
BO)	F/5	
BO-1)	F/17	- Busy Odd (Office Frame - Trunks)
C	D/23	- "C" (Link of Channel)
C-0 to 9 (LO-R9)	I/26	- "C" Linkage (Channel Busy Test)
C-1,2,4,5	D/54-57	- "C" Digit (Register)
CBA-1 to 5)	B/13-17	
CEB-1 to 5)	C/13-17	- Channels Busy (Juncture Retest)
CBC	D/15	- Channels Busy Overflow
CBH	F/16	- Channels Busy Hold
CBL	F/15	- Channels Busy Release
CBR to T	A/D-81	- Connector Busy
CH(LO-R9)	J/26	- Channels (Selected)
CHE	F/26	- Channel End
CHE-1	D/27	- Channel End
CHL	I/23	- Channels Lock
CHT	E/24	- Channel Timing
CIA	J/87	- Cut In (Trouble Indicator)
CIB	H/85	- Cut In (Trouble Indicator)
GIC	H/87	- Cut In (Trouble Indicator)
CID	E/87	- Cut In (Trouble Indicator)
CIE	F/87	- Cut In (Trouble Indicator)
CIG	J/85	- Cut In (Trouble Indicator Zone Registration)
CIF-1 and 2	H/81-82	- Cut In (Marker Test)
CK	B/96	- "C" Link Check (Closed for Busy Test)
CK-1 to 4	H/54-57	- Check (Receiving Leads)
CK-6	H/55	- Check (Receiving Leads)
CLA to D)	I/62	
CLP)	I/63	- Class Lead Check
CLS)	I/63	
CL-0 to 7	I/64-69	- Glass of Call
CO-1 to 3	C/E/G-61	- Cut-Off (Cross Check of Trans. Leads)
CR-0 to 9	G/64-70	- Compensating Resistance
CRA to C	G/62	- CR Lead Check
CRL	D/18	- Channel Release
CRP	G/63	- CR Primary Wdg. Check
CRS	G/63	- CR Secondary Wdg. Check

D-1,2,4,8	E/55-57	- Class of Service
DA-1 and 2	E/79-80	- Decoder Alarm
DB	A/80	- Decoder Busy
DF-0 to 19	H/13	- District Frame
DL	I/34	- Delay (Causes call to use another mkr.)
DLX	I/45	- Delay Cross Test
DMT	I/36	- Decoder Marker Test
DR	B/43	- Denied Route
DT-1 & 3	J/8	- Double Test (S and SI Leads)
DT-2	H/2	- Double Test (S and SI Leads)
EA	C/74	- Extended Area (Code Connector)
EAH-2 to 9'	B/51	- Extended Area (Fifties Relays)
EL	G/8	- Even Left
ER	G/6	- Even Right
F-1,2,4,5,10,10'	F/54-57	- Frame (District Link)
G-1 to 4	I/50	- Ground (Supply)
GOA to G11A)	E/51	- Group (Trunk group preference where there
GOB to G11B)	E/49	- are more than 120 trks. in a group)
GOC to G11C)	E/47	
GP-OA to 1B	B/47	- Group (between 40 and 120 trks.)
GS-1 to 4	I/51	- Ground Supply
GT-1 to 3	G/53-54	- Group transfer - 80 Trks.
GW-0 to 3	G/48-52	- Group (W) Group Transfer
GZ-0 to 3	G/47-49	- Group (Z) Walking Cct.
H-2 to 9'	B/51	- Hundreds (Fifty Code)
HMT	E/27	- Hold Magnet Timing
HMT-1	E/27	- Hold Magnet Timing
JC-0 to 19	I/15	- Junctor Connector
JD	E/13	- Junctor Distribution
K(ELO-OR9)	C/4-7	- Trunk Actually Selected
KP	E/45&C/45	- Key Pulsing
KP-1	B/39	- Key Pulsing
LA	C/77	- Local Area (Code Connector)
MR	D/26	- Message Register (Lead Check)
MR-1	H/97-F/81	- Message Register Failure
MRL	G/97-H/37	- Marker Release
NC	C/40	- Non-Charge
NC-1	B/40	- Non-Charge
NSE	I/5	- Non Split Even
NSO	I/3	- Non-Split Odd

O-O to 9	H/18	- (Pair of) Office (Frame Check)
OB-O to 9	A/64-70	- Office Brush
OBA to D	A/62-63	- Office Brush Lead Check
OBP	A/63	- Office Brush Primary
OBS	A/63	- Office Brush Secondary
OCB	E/94	- Office Conn. Busy
OF	I/56	- Overflow (Receiving Lead - 3rd Trial)
OF-1	D/43	- Overflow " " " "
OG-O to 5	C/63-67	- Office Group
OGA to C	C/62	- Office Group Lead Check
OGP	C/63	- Office Group Primary
OGS	C/63	- Office Group Secondary
OL	G/7	- Odd Left
OR	G/5	- Odd Right
OT	C/38	- Operator Transmission
OT-1	B/38	- Operator Transmission
OV	C/39	- Overflow
P	C/4-7	- Panel (Trunk Test)
P-O to 13	J/18	- Pattern
PA-O to 4	J/13	- Pattern Auxiliary
PS	C/41	- Permanent Signal
PS-1	D/90-B/41	- Permanent Signal
PS-2	D/98	- Permanent Signal
PT	I/6	- Panel Timing
R	I/47	- Route
RL	D/41	- Release Timing
RP-1	B/36	- Ring Party
RX	E/34	- Remove Cross Test Relays
RT-O-4	A51&53	- Route Transfer
S	D/24	- Sleeve (of OGT grded.)
S-O to 19	D/49	- (Class of) Service
SB-O to 9	D/64-70	- Second Office Brush
SBA to D	E/62	- Second Office Brush Lead Check
SBP	D/63	- Second Office Brush Primary
SBS	E/63	- Second Office Brush Secondary
SDT	D/83&G/39	- Sender Test
SDT-1 and	D/83	- Sender Test
SDTA	I/34	- Sender Test
SGA to C	F/62-63	- Second Office Group Lead Check
SG-O to 5	A/92-F/64-67	- Second Office Group
SGP	F/63	- Second Office Group Primary
SGR-SGR'	I/81	- Second Group (Class of Sub's)
SGS	F/63	- Second Office Group Secondary
SIK	B/23	- Sleeve Check (S-1 Lead)
SL	B/23	- Sleeve (District Junctor)
SM	E&G/73	- Select Magnet
SP	J/63	- Special (Indication from Route Relay)
SPE	I/6	- Split Even
SPL	H/27	- Split Left
SPT	F/94	- Stop Timing
SPO	I/4	- Split Odd
SPR	H/21	- Split Right
SR	G/40	- Sender Release
ST-3,4,5	F/H-42	- Start
ST-1	H/37	- Start
ST-2	B/F-95	- Start
STX	H/10	- Start Cross (Transfer from cross detecting relay to battery)

T	A/4-7	- Test (Trunks for Busy)
TB	J/54	- Trunks Busy
TB-1 to 5	J/48-51	- Trunks Busy (Ground Supply Group 1-5)
TBL	J/3	- Trunks Busy Lock
TC	B/37	- Talking Charge
TC-1	B/37	- Talking Charge
TCK	D/39	- Talking Charge Check (Ground Returned)
TG	B/4-7	- Trunk Group (Start and End)
TIB	G/35	- Trouble Indicator Busy
TK	B/43	- Transmitting Check
TKE	J/6	- Trunk End (Trk. Selected)
TL-0 to 14	E/38-40	- Trunk Level
TM	E/95	- Time Measure
TM-7 to 9	H/35	- Time Measure
TM-1	I/39	-
TM-4,5,6	I/42	- Time Measure
TMS	B/E-97	- Time Measure
TMS-1 and 2	I/37	- Time Measure Start
TMW	I/38	- Time Measure (W)
TMZ	I/38	- Time Measure (Z)
TM8A,B,C	H/J-32	- Time Measure
TMS	H/32	- Time Measure
TN-0 to 4	D/52	- Tens (Code)
TP	I/57	- Tip Party
TP-1	B/35	- Tip Party
TPK	C/35	- Tip Party Check
TR	G/36	- Trouble Release (T.I. Start)
TW	C/43	- Two Wire (Office)
TWA	I/64	- Two Wire Alternate
X		
XBE	I/6	- Busy Even) Off. Fr. Delay
XBO	I/7	- Busy Odd) Off. Fr. Delay
XC	D/33	- Cross Charge
XCH	D/20	- Cross Channel
XCL	I/61	- Cross Class
XCR	G/61	- Cross Compensating Resistance
XDC	G/44	
XGE	F/9	- Cross Group End
XGS	F/10	- Cross Group Start
XK	G/9	- Cross Check Leads
XK-1	B/89	- Cross Check Leads
XLC	F/3	- Cross Link Connector (Office)
XLC-1	F/3	- Cross Link Connector (Office)
XOB	A/61	- Cross Office Brush
XOF	E/37	- Cross Office Frame
XOG	C/61	- Cross Office Group
XRL	G/34	Cross Release Lead
XS	G/10	- Cross Sleeve (Office S Lead)
XS-1	G/10	- Cross Sleeve S-1 Leads)
XSB	D/61	- Cross Second Office Brush
XSG	F/61	- Cross Second Office Group
XSL	F/20	- Cross Sleeve (District Junctor)
XSM	E/20	- Cross Select Magnet
XSM-1-2	G/79	
XSS	G/8	- Cross Secondary Select (Office Link)
XT	E/60	- Cross Transmitting Lead
XT-1 & 2	D/60	- Cross Transmitting Lead

XTC	E/33	- Cross Talking Charge
XTL	E/37	- Cross Trunk Level
XTL-1 to 3	E/31-32	- Cross Trunk Level
XX-1 and 2	F/33	- Cross Master Relays
XZ	E/36	- Cross Zone
XZS	E/35	- Cross Zone Start
XDF-1	H/11	
ZA to ZJ	C/32-34	- Zone Charging
ZA-1 to ZJ-1	B/32-34	✕ Zone Auxiliary
ZCK	D/38	- Zone Check
ZL	D/34	- Zone Lock
ZO	D/37	- Zone Overflow (Zone Timers Busy)

MR-1

METHOD FOR TESTING FOR OPEN OR REVERSED M1 LEAD IN A

NUMBER ONE X-BAR OFFICE

When it is desired to test the M1 lead between the line link primary switch and the district junctor for open or reverse, block the MR 1 relay non-operated in all the originating markers.

When a flat or measured business call is placed by the subscriber the M1 lead is grounded from the meter or LDF and it is extended through the x-points to the district junctor circuit. (See Sketch).

When the originating marker is called in, the ground is extended to operate a MR relay. If the MR relay fails to operate by not receiving the M1 ground, then the MR 1 relay will operate and the marker will block the call and release itself without a trouble indication being recorded.

If the MR 1 is blocked non-operated the marker can not release itself therefore the trouble indicator is called in and a No. MR indication is shown.

The indication will show the district junctor, and from this information you will be able to test from the district junctor M1 lead to the various line links to find your open or reverse.

Normally the subscriber would not receive any tone but when the MR 1 is blocked the subscriber will receive an overflow signal.

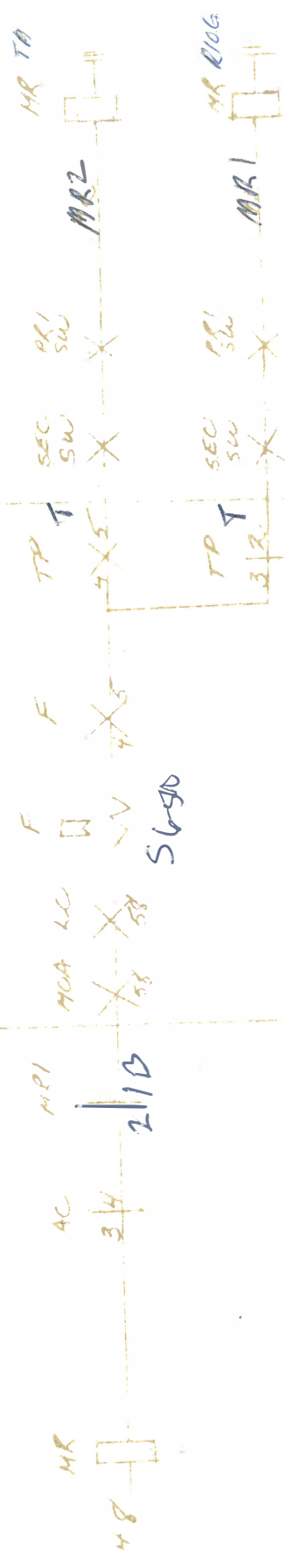
For more details of the relay operation see CD 25016 Par. 46.8 and 47, No. 1 crossbar switching system OS 337-1, SD 25020.



LINE 1.000

DISTRICT JUDGE

1948-49



R 61079



